SCIENTIFIC AMERICAN

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WINBY'S EXPRESS LOCOMOTIVE AT THE COLUMBIAN EXPOSITION.

Among the striking exhibits at the great Exposition are the locomotives from foreign lands, of which several from England and France take high rank. One of the most imposing of these is the English locomotive designed by Mr. Winby, of the firm of Westwood & Winby, of London. We give an engraving of this fine piece of mechanism, for which and the following particulars we are indebted to *The Engineer*, London.

Dimensions of Winby's Locomotive.

Boiler (steel)—	
Height of center from rail	8 ft. 2½ in.
Length of barrel	9 ft. 2¼ in.
Thickness of plates	9/16 in.
Thickness of smoke-box tube plate	¾ in.
Fire box shell (steel)—	
Length outside	8 ft. 11⅛ in.
Breadth outside at bottom	3 ft. 11¾ in.
Depth below center of boiler, front	6 ft. 8¼ in.
Depth below center of boiler, back	5 ft. 10¼ in.
Thickness of wrapper plates	5/8 in.
Thickness of throat plates	5/8 in.
Thickness of back plates	5/8 in.
Fire box (copper)—	
Length at bottom inside	8 ft. 3¾ in.
Breadth at bottom inside	3 ft. 4½ in.
Center of boiler to top of box front	1 ft. 4 in.
Center of boiler to top of box back	1 ft. 1½ in.
Thickness of tube plate	7/8 in.
Thickness of other plates	½ in.
Tubes (brass)—	
Number	235
Length between tube plates	14 ft. 9¼ in.
Diameter outside	2 in.
Chimney—	
Height from rail	13 ft. 6 in.
Diameter inside	1 ft. 9 in.
Heating surface—	
Tubes	1817·4 sq. ft.
Fire box	182·6 "
Total	2000·0 "
Grate	28·0 "
Working pressure	175 lb. per sq. in.

Weight in working order—	Tons	cwt.	qrs.
Bogie	25	0	0
Leading driving	18	0	0
Trailing	17	0	0
Total	60	0	0

Tractive force per lb. of pressure 143·2

Brake—The Westinghouse quick-acting brake is fitted.

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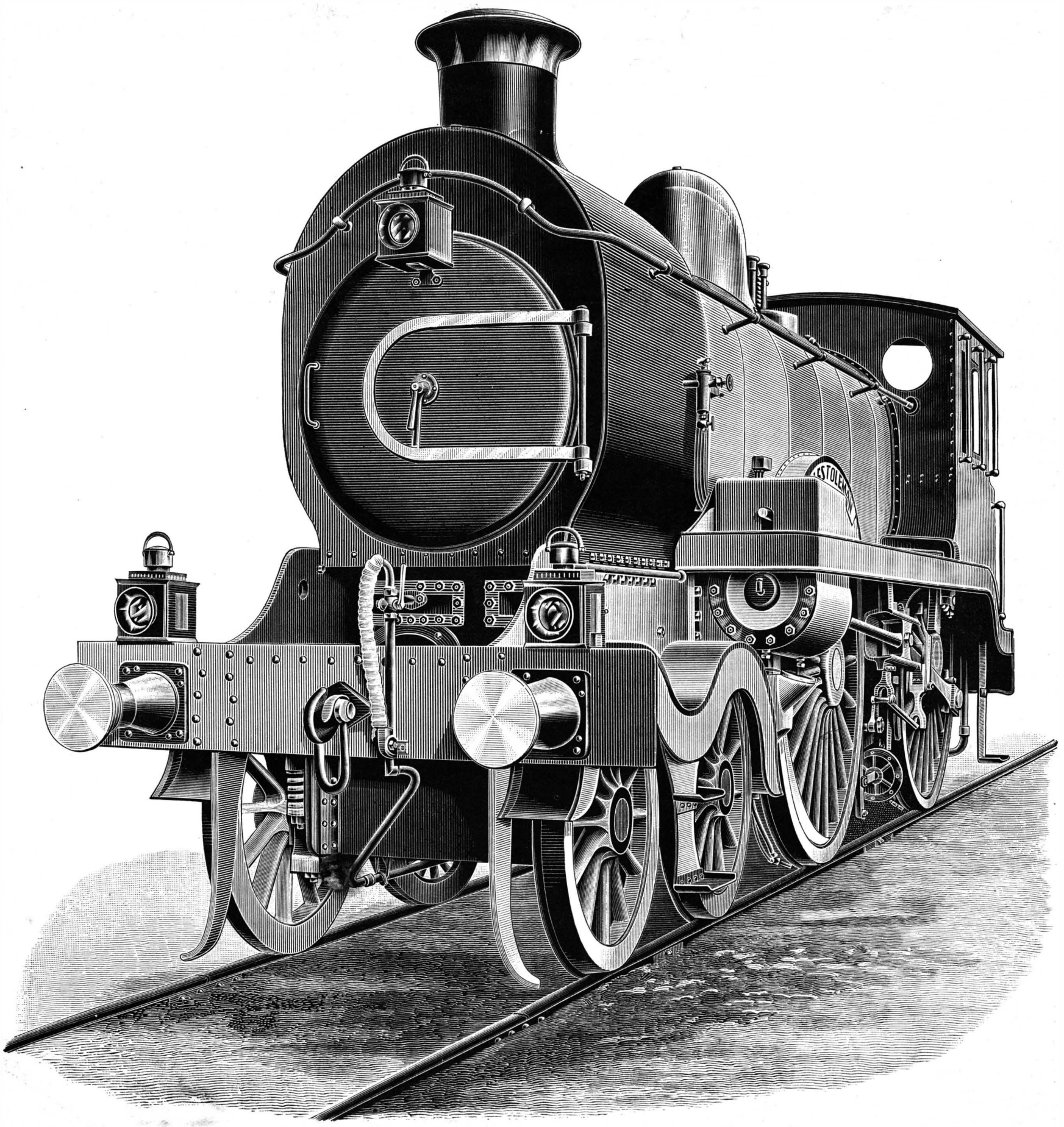

THE WORLD'S COLUMBIAN EXPOSITION—WINBY'S FOUR-CYLINDER ENGLISH EXPRESS LOCOMOTIVE.

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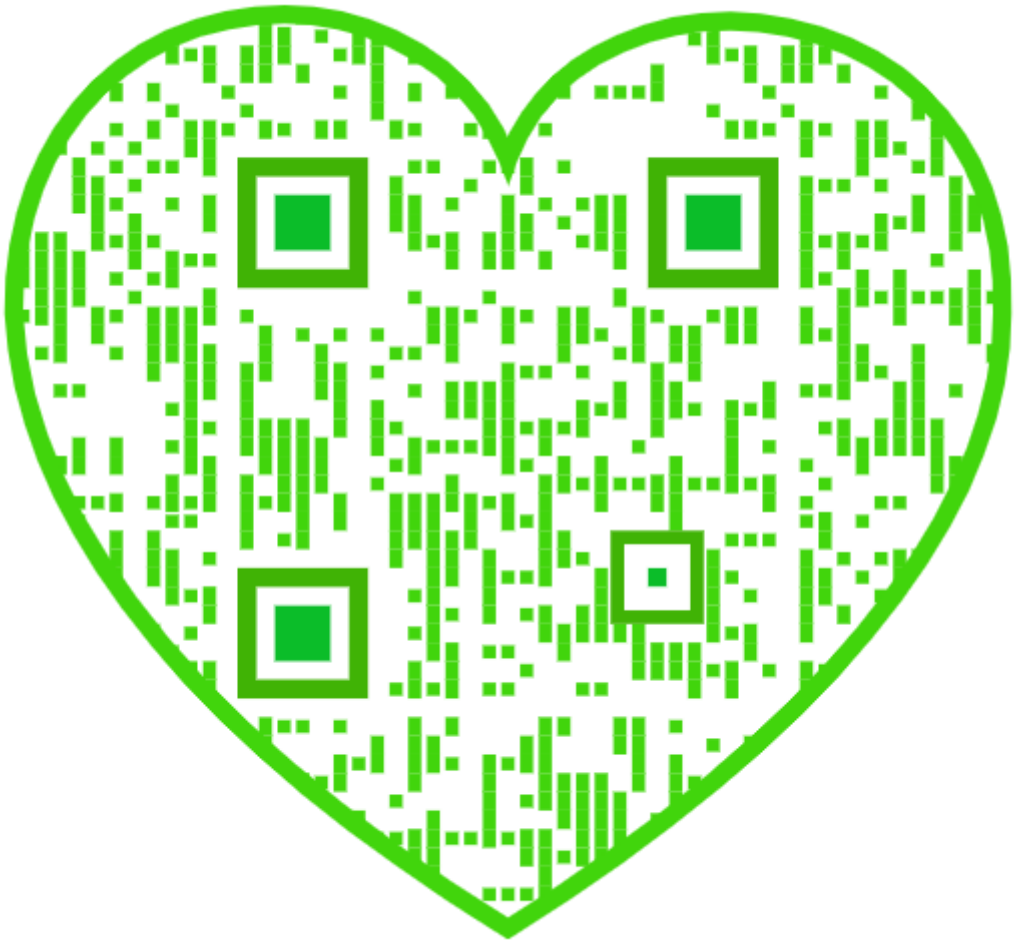

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TESTS AND AWARDS AT THE WORLD'S FAIR.

Considerable feeling has been caused among exhibitors, both domestic and foreign, over the uncertainty as to the manner in which tests and awards are to be made at the World's Columbian Exposition. The American Society of Mechanical Engineers made recommendations some time ago as to tests of engines, boilers, etc., but the committee on awards has made no announcement as to whether the recommendations will be acted upon in whole or in part. In regard to awards, a plan of action has been carefully studied out, but does not seem to be well received, especially by the foreign commissioners.

This system possesses many features which recommend it over the much used comparative merit plan. The principle upon which the proposed plan is based is the merit of the exhibit as compared with a certain standard set by the Exposition, and the question of making awards is to be primarily in the hands of experts who report to a department committee. In making the award consideration is given to whatever originality there may be in the exhibit, importance to the commercial world, and whatever other facts concern the exhibit. By making awards on this basis, exhibitors are not pitted against each other, and one exhibit will not be placed in second, third or fourth class, while another exhibit, probably no more deserving, is awarded first prize. Again, an award made on this proposed plan carries with it a guaranteed degree of excellence and quality, whether it stood alone in its class at the Exposition or whether there were many other exhibits in the same class, all of a more or less degree of excellence.

Representatives of Germany, Great Britain, France, Belgium, Italy and Russia, in entering their protest against this proposed method of making awards, expressed the belief that there was not sufficient time to examine all the exhibits on the lines of the proposed plan; they considered the system of graduated awards as preferable to the system proposed, asking that at least there be a distinction as to the degree of merit of the exhibit, and unless these and other concessions asked for in the matter of awards were made, the commissioners reserved the right of placing their respective exhibits *hors concours* and of withdrawing them from the consideration of the judges.

It is unfortunate that such a crisis as this should arise, yet it will probably result in good to both sides of the question and lead to the adoption of some satisfactory policy. The proposed plan carries with it some excellent ideas, especially the one that an exhibit must possess a stated degree of excellence to receive any award. Furthermore, on general principles it would seem wiser to make an award on the report of an individual expert, with the sanction of a department committee, than to imitate the old custom of making an award by comparing one exhibit against another, on the recommendation of several men who are chosen for the purpose.

In the matter of tests, it is of great importance to the mechanical and industrial world that there be a series of tests more comprehensive and exhaustive than any ever yet contemplated. There have been such refinements of late years in the matter of generating and applying energy that it is of much importance that whatever tests are made be so complete as to become a universal standard. The Exposition engineers appreciate the importance of this and have been engaged for months in preparing the preliminaries necessary to carry on the tests.

ELECTRICAL ENGINEERING AS A PROFESSION.

One of the most eminent and practical working electricians of the country, in a recent article, urges young men to keep out of electrical engineering unless they are willing to work hard and have an instinctive hankering for this line of work. If they think they fulfill these conditions, they should by all means secure a practical education in some good scientific school, and then bend all their energies in one particular direction. Electrical engineering has become specialized, like all other lines of engineering, and there is opportunity for so much work and investigation in any one special line that few men can master more than one. It is particularly noticeable in this connection that the World's Columbian Exposition has had its regular force of electricians and electrical engineers, yet in laying out the lighting and other large engineering schemes has employed specialists as consulting engineers, and by doing so has prevented several glaring failures, particularly in lighting effects. The demand for such specialists is limited, but the supply is never too great, and is not keeping up in quality with the increased demand.

But in urging upon young men to make themselves competent specialists, the writer in question did not refer alone to such lofty positions as are only within the intellectual scope of a chosen few, but more particularly to lesser yet in their way equally important lines of work. There are not many engineers in the country that thoroughly understand all the fine and necessary points required in planning and equipping an electric station of medium or large capacity. Nor is there anywhere near supply enough of men who are competent to take charge of a plant, put it into good running condition, keep it in such order that consumers of light or current can feel as sure of their supply as they are of the coming of each day, and at the same time have in mind the fact that while he is maintaining the highest efficiency in the plant, he is remembering that the stockholders are looking to him to operate the plant with a high degree of economy. In this particular line of work there are probably better openings for intelligent, well-trained young men than in any other line. Whatever the work may be—and it is equally true of all lines of engineering—the successful men are, as a rule, those who fully master one branch of their chosen profession.

Fiber from the Dwarf Palm in Algeria.

The French *Monde Economique* says that the dwarf palm, which furnishes considerable quantities of fiber, grows in great profusion in Algeria, and is one of the principal obstacles to the clearing of the land, so thickly does it grow and so difficult to pull up; its roots, in shape resembling carrots, penetrate into the ground to the depth of a yard or more, and when its stem is only cut, it sprouts out again almost immediately. As its name indicates, this palm is very small, and can only attain a certain height when protected, as in the Arab cemeteries, for example.

Various uses are made of this plant. Its roots serve as combustibles, a light kind of coal being made out of them, and the natives have employed the fibers that they extracted from the leaves and the stems, mixed with camel hair or wool, in the manufacture of stuffs for tents; with the leaf itself they make baskets, mats, hats, fans, bags, and other articles. Considerable attention is now being paid by the authorities to the encouragement of this industry in Algeria, as, in the first place, it affords to the Arabs an easy means of making a living, and, in the second, the land is thus rapidly cleared of this parasite. The idea of embarking in the industry of fiber production from the dwarf palm originated, a few years ago, with a landed proprietor living in Cheragas, about eight miles from Algiers. At the present time there are in Algeria numerous establishments which are devoted to this branch of industrial enterprise. The principal factories are those of Aversing, Elaffroun, Chiffa, Duperre and Douera, and the exports of late years have exhibited a decided increase. In 1880, the quantity of fiber exported from Algeria amounted to 9,000,000 kilogrammes, in 1885 to 15,000,000 kilogrammes, and in 1891 to 19,000,000 kilogrammes.

In preparing the fiber, the following is the system adopted. The leaves are plucked by the Arabs, and carried into the courtyard of the factory in a green state, at a price of twenty francs per ton. As they are at once used, and as they fear neither the rain nor the sun, it is only necessary to pile them on the floor in a heap. The first operation consists of sorting, which is effected by women and children. The weeds are removed from the stems which frequently adhere to them and the broken or dried-up leaves are cut away. Another operation consists in combing the leaves, or rather in carding them. This is effected as follows: A workman holds tightly in his right hand a handful of green leaves which he applies to a small carding machine. This machine consists of a drum on which some nails have been roughly fixed, and is constantly turning with great rapidity. To protect the hands of the workman it is incased in wood, with only an opening sufficiently large to admit the leaves. As it is necessary that these leaves should be damped during the work, a tap is placed above the drum, from which a constant stream of water falls upon the leaves. With this most primitive system, a workman is able to card from five to six hundred kilogrammes—1,000 to 1,300 pounds—of leaves a day.

When the leaves have been combed at both ends, they present the appearance of a handful of rough and short fiber. They are then dried, and, after certain preparations, are ready for use in stuffing chairs, couches, etc. To curl the fiber, a workman takes up a quantity of carded leaves and applies it to a bent hook, fixed upon the axle of a wheel, which is turned by a child. The first fibers accumulate round the hook, and wind themselves round it; the latter, which is constantly turning, draws in the others, and the workman recedes from the wheel while grinding the fibers with his hand. The latter soon constitute a sort of cord, one end of which is fixed to the hook, the other held firmly and horizontally by the workman. At this stage of the proceedings, the child who turns the wheel stops and detaches one extremity of the cord, which he returns to the workman, after having passed it round the hook. In this operation the cord is subject to the natural impulse of twisting and rolls up on itself, so that it is only necessary to fix the ends so that it cannot come unrolled. The fiber is kept in this condition for several weeks, and is then untwisted, and is then considered to be sufficiently curled. African fiber is employed in its natural state or dyed. In the latter case, the fibers are passed through various solutions of sulphate of iron and logwood, then curled, and again plunged into the solution.

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An official list of the concessions at the World's Columbian Exposition grounds has just been published, giving the purpose of each concession and the admission fee, wherever there is one. Most of these concessions are located in the Midway Plaisance and none of them are regarded in any sense as a part of the Exposition proper, but as mere side shows.

Following is a list of the more important of these concessions in the Midway Plaisance:

Constantinople street scene, including theater, restaurant, etc. Admission 25 cents.

Cairo street scene, Egyptian museums, theater, etc. Admission 25 cents. Egyptian Temple, admission 25 cents more.

Dutch East Indies village, with theater, music, dancing, etc. Admission 25 cents.

German village of mediæval times, with music, restaurant, etc. Admission 25 cents.

Natatorium, with music. Admission, with use of bath, 50 cents.

Moorish palace, with sale of native goods, chamber of horrors, cafe, etc. Admission to museum features, 25 cents.

Panorama of Bernese Alps in Switzerland. Admission 50 cents.

Panorama of the volcano of Mt. Kilauea, Sandwich Islands. Admission 50 cents.

Algerian village, with streets, bazars, cafe, etc. Admission 25 cents.

Hungarian concert pavilion and cafe, with musical theatrical performance, etc. Admission 25 cents.

Venetian glassware and mosaics, with factory in full operation and sale of wares. Admission 25 cents.

Chinese village, with theater, joss house, tea garden and cafe. Admission to theater and joss house 25 cents.

Irish village and Blarney Castle. Exhibition and sale of Irish products. Admission free.

Persian building, with sale of Persian goods, musical entertainment, etc. Admission 50 cents.

Beauty show of women from forty or more countries. Admission 25 cents.

Typical Irish village. Admission 25 cents.

Japanese bazar, for the sale of Japanese wares. Admission free.

Vienna cafe and concert hall. Admission free.

Model of St. Peter's Church, Rome. Admission 25 cents.

Hagenbeck's animal show. Admission 25 cents.

Model of Eiffel tower. Admission 25 cents.

Electric scenic theater. Admission 25 cents.

East Indian bazar for the sale of native wares. Admission free.

Captive balloon. Admission 25 cents. Trip in balloon $2.

Inside of Exposition grounds proper are the following special concessions:

Esquimau village, representing a Labrador trading post. Admission 25 cents.

Japanese tea house on the Wooded Island. Admission varying according to purchases.

Ruins of Cliff dwellers and an exhibition of antiquities. Admission 25 cents.

Crystal cave in Horticultural building. Admission free.

Whaling bark Progress, with museum. Admission 25 cents.

In addition to these there are the several concessions for methods of transportation, including movable sidewalk on the pier at 5 cents a ride; the Ferris wheel, at 50 cents a ride; elevator to the promenade on the roof of the Manufactures and Liberal Arts building, 25 cents; elevator to the roof on the Transportation building, 10 cents; ride in gondola, around the basin and lagoon, 50 cents; wheel chair, 75 cents an hour with attendant; ride in electric launch through the lagoons and basin, 25 cents; ride in steam launch through the lagoon and out into Lake Michigan, 25 cents; round trip on the Intramural Railway, 10 cents; ride on a donkey or camel in the streets of Cairo, 50 cents and 25 cents per ride respectively; use of sedan chairs, $1.

There has been considerable trouble especially with exhibitors in the Manufactures and Liberal Arts building because of their selling goods that have been imported free of duty, without paying the duty. Customs officials notified several of these exhibitors that they were amenable to the law, but the notification did not seem to be regarded. So many cases occurred that an English exhibitor was arrested and taken before the United States commissioner on the charge of smuggling. He was dealt with leniently, but other exhibitors were cautioned to be more careful, as in future cases they would be held accountable.

The failure of Commercial National Bank of Chicago was a serious complication to exhibitors and concessionaires at the Exposition, because of the fact that this bank operated the national bank recently established in the Administration building. The failure of the bank not only locked up a large amount of deposits, but prevented the opening of another bank, as this one was established under an act of Congress. Pending the settlement of the bank's affairs, President Higginbotham, of the Exposition, and other wealthy men of Chicago, guaranteed the deposits of foreign and other exhibitors, so they were able to obtain their money and were not embarrassed by its being tied up. The amount that these men became liable for was about $75,000.

Mr. A. T. Goshorn, who was Director General of the Centennial Exposition in Philadelphia, was in Chicago recently and was surprised at the greatness of the Columbian Exposition. At an informal reception by the National Commission Mr. Goshorn congratulated the committee on the scale upon which the Columbian Exposition was planned, upon the beauty of its architecture and of the grounds, and of the forward condition in which the exhibits were.

An interesting exhibit was installed in the gallery of the Transportation building soon after the opening of the Exposition, being a relief map on a large scale of the Nicaragua Canal, showing the entire route of canal, with mountains, cuts, etc. The exhibit is made very practical by the use of running water to demonstrate the manner in which the canal will be operated.

The completion of the elevators which are to carry visitors to the promenade on the roof of the Manufactures and Liberal Arts building was an event of considerable interest. This elevator has a direct lift of 185 feet, and the sensation of going up in it is quite startling, because of the fact that there are no walls on any side of it and the ride seems like a flight through the air. The upper landing for the elevator is near the roof, which is reached by a short flight of steps. The view from the promenade is a fine one, as it commands the entire Exposition grounds, while at the north lies the city of Chicago and to the east on a clear day is plainly seen the shore of Michigan. The promenade is 80 feet wide and is guarded on either side by high and strong metal fencing. The view of Lake Michigan is one of the most attractive features of the promenade.

The local directory voted on May 12 that the Exposition grounds should be opened Sundays, beginning Sunday, May 21. This action was taken upon the recommendation of the legal adviser of the board, and was in accordance with the action recently taken by the National Committee, which left the question of Sunday opening to the local directory for decision. The legal opinion was that the local directory could open the grounds to the public, keep the Exposition buildings closed and not come in conflict with the act of Congress, which prohibited Sunday opening. Because of the buildings not being open the entrance fee to the grounds was reduced from 50 to 25 cents. This action of the board brings to a climax the Sunday question, which has so long been agitated, and in connection with it the leading stockholders of the Exposition, including the city of Chicago and its park commissioners, ask the court to compel the Exposition management to open the Exposition Sundays. On the other hand, there is every probability of an application to the court to compel the Exposition to obey the act of Congress and not open the Exposition on Sundays. The question will be speedily settled, if possible, and, if in favor of Sunday opening, the concessions on the Midway Plaisance and many foreign buildings will be open to the public, so that Sunday visitors will see some of the most interesting things in the Exposition grounds. This action was only preliminary, and there is a probability that it will result in the whole Exposition being opened, but without the machinery being in operation.

When the strike of the carpenters in the employ of the Exposition was settled about the middle of April, it was agreed that delegates representing the Carpenters' Union should be given passes to the Exposition grounds in order that they might see what work the Union carpenters were doing, and to be assured that the Exposition was keeping within its agreement with the Union, and that the carpenters were keeping up their end of the agreement. When the second strike of the carpenters was ordered, within a week of the settlement of the first strike, the men did not quit work, but the representatives broke their agreement with the Exposition, and when they applied for their passes were refused them on these grounds. Many of the carpenters have withdrawn from the Union.

A decidedly unpleasant trouble has arisen between the Exposition management and the music department, because of the refusal of leading piano manufacturers in the East to exhibit. The instruments of one of these bolting manufacturers were used at some of the concerts, and the piano manufacturers who did exhibit considered it an injustice to them that a bolting manufacturer be permitted to reap the benefit of the use of his instruments in the concerts when he did not take part in the Exposition. Some serious charges were made against the music department, among these being one that the director of the department was working wholly in the interest of one of the bolting concerns. Much unnecessary ill feeling has been stirred up, and more attention has been given to this matter than to some of the most important matters that have come before the directory.

An exhibition test of the fire department of the Exposition was given May 13, for the benefit of the insurance interests which are carrying policies in the Exposition grounds, and also for the Chicago fire department and officials of the Exposition. An alarm was rung in at exactly ten o'clock, at the southeastern corner of the Manufactures and Liberal Arts building, and in half a minute one engine and truck were in place. In another minute six engines and a fire boat were throwing streams of water, and in less than five minutes of the time the alarm was sounded a one hundred and sixty foot extension ladder was in position on the side of the building and firemen were at the top of the ladder with a lead of hose, throwing water upon the roof. Six hundred or more Columbian Guards were also on hand to act as firemen, and in other ways assist the fire department. This exhibition was decidedly satisfactory to the insurance interests and demonstrated that every possible advantage for fighting fire was provided. In addition to this equipment of the fire department a third alarm would bring twelve fire engines belonging to the city of Chicago into the grounds and a fire boat from South Chicago.

Forty-two foreign nations are now represented at the Exposition by three hundred and twenty-seven representatives. These men are from all parts of the world, and the several nations and states with their representatives are as follows: Argentine Republic, 5; Austria, 9; Belgium, 10; Brazil, 21; British Guiana, 1; Bulgaria, 1; Canada, 24; Cape Colony, 4; Ceylon, 2; Colombia, 1; Costa Rica, 7; Curacoa, 1; Denmark, 10; Ecuador, 5; France, 25; Germany, 44; Great Britain, 11; Greece, 2; Hayti, 4; Italy, 11; Jamaica, 3; Japan, 9; Johore, 2; Liberia, 3; Mexico, 22; Netherlands, 2; New South Wales, 10; Nicaragua, 1; Norway, 8; Orange Free State, 1; Paraguay, 5; Persia, 2; Portugal, 2; Russia, 12; Siam, 3; Spain 13; Sweden, 8; Switzerland, 2; Trinidad, 1; Turkey, 5; Uruguay, 5; Venezuela, 10.

Every precaution possible has been taken to protect the purity of the water supply at the Exposition. Spring water is supplied at 150 or more booths throughout the grounds for one cent a glass. This, however, is a concession. The Exposition itself provided one hundred or more drinking fountains throughout the grounds and as many more in the Exposition buildings which furnish water filtered on the latest improved scientific methods. Further precaution has been taken, not only in the Exposition grounds and throughout the buildings, but also in Midway Plaisance, to prevent water being used for drinking purposes that has not been properly filtered.

The Cage Bird Club.

The Cage Bird Club was inaugurated recently in London, Dr. Martin, chairman of the Norton Ornithological Society and vice-president of the London Cage Bird Association, presiding. A paper was read by Mr. W. H. Betts, auditor of the Crested Canary Club, in which he stated that the object of the club was the enrollment among its members of ladies and gentlemen who, from the fact that the majority of cage bird clubs were held at public houses, were debarred from membership thereof. He said the club would endeavor to train novices in the management of cage birds, would give encouragement and assistance to ornithological societies generally, would circulate literature with the object of elevating the moral tone of the cage bird fancy, and would endeavor to prevent cheating at shows, and to put an end to brutality. One very common practice which the club would endeavor to stop was that known as "tailing and fighting." This consisted in taking a young bird, a month or six weeks old, and in wrenching daily from its wings and tail two or three quills. The bird was thereby kept in lingering pain for weeks, and sometimes its wings were dislocated, the only object of such barbarity being the off-chance of winning a prize of the value of a few shillings a little sooner than was otherwise possible.

A Long Snow Journey.

A journey of 1,800 miles on snow shoes has been made by a Mr. C. H. Hamilton, an employe of the Yukon River Transportation and Trading Company. He was frozen in with a steamer of the company two weeks' journey above the mouth of the Yukon, and was sent to carry the news to his company at Seattle. He started on November 23 with three sleds, twenty-one dogs, and some Indian guides, and arrived at Chilkoot, 80 miles above Juneau, on March 20, after an 1,800 mile trip.

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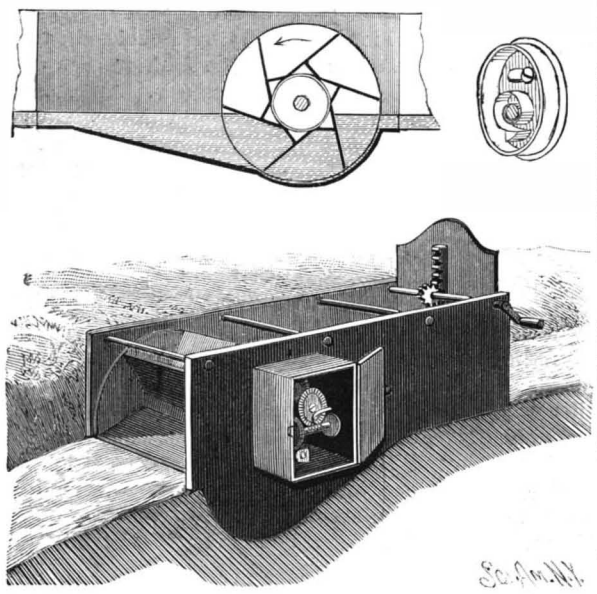
A ROTARY WATER METER.

The improved meter shown in the illustration, designed more especially for use in irrigating ditches, is adapted to accurately measure and register the quantity of water used, no matter how much or how little it may be, and however it may vary through the day or night. A flume set in the ditch or channel through which the water flows has near its discharge end a pit in which is journaled a wheel, the circular ends of which fit closely to the sides of the flume, as shown in the sectional view, and the wheel shaft being connected



WOOLLENS' METER FOR IRRIGATION DITCHES.

with a suitable counting or recording apparatus. The construction is such that one of the several buckets will always be in the pit, and, the bottoms of the inlet and outlet of the flume being on a level with the bottoms of the buckets, no one of the buckets can discharge until it has been completely filled. The small figure represents a device to prevent the wheel being turned backward. Both the register and detent are preferably kept under lock and key to prevent tampering with the meter, and the stopping of the measuring wheel prevents any further flow of water. The register is designed to keep a record, without further attention, of all the water which can go through for at least thirty-five days and nights, the wheel having a velocity corresponding to the volume of water passing through it.

Further information relative to this improvement may be obtained of the patentee, Mr. Theodore Woollens, Jr., Cheyenne, Wyoming.

ARTISTIC AND COMFORTABLE FURNITURE.

The central figure in the accompanying illustration represents a novel arrangement to conceal two ugly doors, while allowing one or both to be opened if necessary. The divan in the center is divided, and is formed in two seats, with backs, which can be used in any part of the room. The doors are covered by a curtain, with a brass rod, and the fabric should be heavy enough to prevent draughts. The woodwork matches the dado.

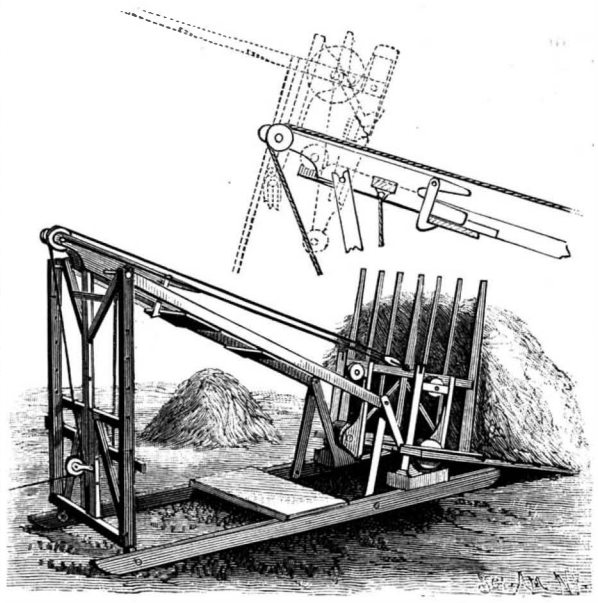
The chairs shown are representations of the work of Chippendale, an English cabinetmaker, who attained distinction about a hundred years ago, and whose productions have ever since been copied, though but seldom with a reproduction of the spirit of the original, as Chippendale was an artist as well as a skillful handicraftsman. They represent both dining-room and drawing-room chairs, but are of a period when the line was not so sharply drawn between the articles of furniture appropriate for the two apartments respectively as is the case at present. We are indebted for our illustrations to the *Furniture Trade Review*.

Photographic Properties of Cerium Salts.

Messrs. A. and L. Lumiere have found that light, under certain circumstances, rapidly reduces the persalts of cerium to the cerous condition, and the reaction may form the basis of interesting photographic processes. Gelatinized or highly sized paper is sensitized by a solution of ceric sulphate or nitrate, which colors the paper strongly yellow. The paper being now exposed under a transparent positive, the exposed parts become bleached by reduction to the cerous condition. On now treating with organic matters which the ceric compounds can oxidize into coloring compounds, a positive image is developed on the paper. Thus, an acid solution of phenol gives a gray print, aniline salts give green, alpha-naphthylamine blue, amido-benzoic acid brown. Cerium papers are more sensitive than iron or manganese papers.

AN IMPROVED HAY STACKER.

A machine of light and simple construction, which may be readily moved about a field and easily operated to deliver hay where required in building stacks of various sizes, is shown in the accompanying illustration, the small view representing in dotted lines the position of the carriage in delivering the hay. The improvement has been patented by Mr. Isaac Allen, of La Belle, Mo. The inclined tracks and the standards and uprights are pivotally connected, and the tracks at their upper ends are connected by a rod on which is pivoted a dumping arm carrying at its outer end an adjustably journaled friction pulley and at its inner end a latch. The standard holding the tracks at their upper ends is made in two sections, the uprights of the upper section extending downward through those of the lower section, and being held at the desired elevation by means of pins, to give any desired inclination to the tracks. The carriage is preferably L-shaped and has a lower section which may assume a horizontal position when receiving its load, and an upper section which may assume a vertical position. Wheels are so located as to rest upon the platform or travel upon the track, and upon a central cross bar of the carriage is a pulley, a rope attached at one end to the outer end of the dumping arm passing over this

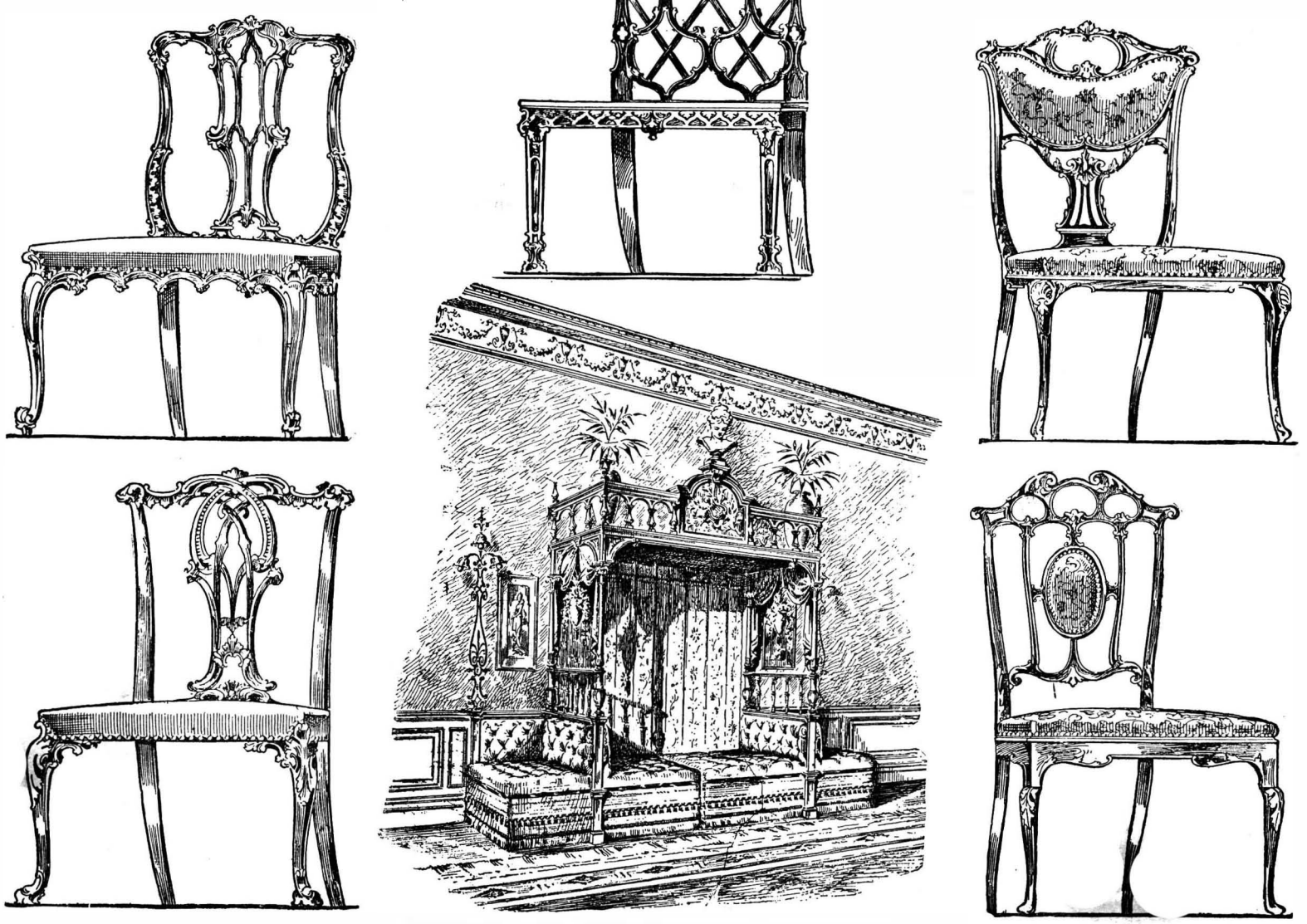


ALLEN'S HAY STACKER.

pulley, thence over a pulley in the rear extremity of dumping arm and downward over a third pulley near the base of the standard, and out from the machine, forming the draught rope. When the load of hay has been received, the carriage is first rolled or tilted on its wheels as the rope is drawn upon, the hay being thus rolled to the center of the carrier, which is then drawn up the track until the latch engaging the dumping arm is automatically released, when the load is dumped. The construction is such that the carriage is not liable to leave the track, and it is easily restored to position to receive another load.

For Closing Milk Bottles Air Tight.

An exchange accredits it to a Frenchman, and it consists simply of a disk of red India rubber with a conical finger or nipple on its under side. This goes into the neck of the bottle, and the milk is then boiled by immersing the bottle in a bath of boiling water. It is afterward cooled by withdrawing it from the water, and the partial vacuum inside the bottle sucks the cork firmly into the neck and effectually closes it. A metallic cover is then placed over all.



ARTISTIC AND COMFORTABLE FURNITURE.

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Fall of Aerolites.

A dispatch in the New York *Tribune* from Ossawatomie, Kan., states that an aerolite fell near that town in the afternoon, April 8, striking the monument to John Brown, "Ossawatomie Brown," as he was sometimes called, erected to him by private subscription originated by Horace Greeley in 1863. The meteor broke off the left arm of the statue. It passed through the dome and nave in a slightly southeasterly direction, and through six feet of clay just south of the crypt, stopping only at bedrock. Experts say the aerolite is composed of metal supposed to exist only in the sun.

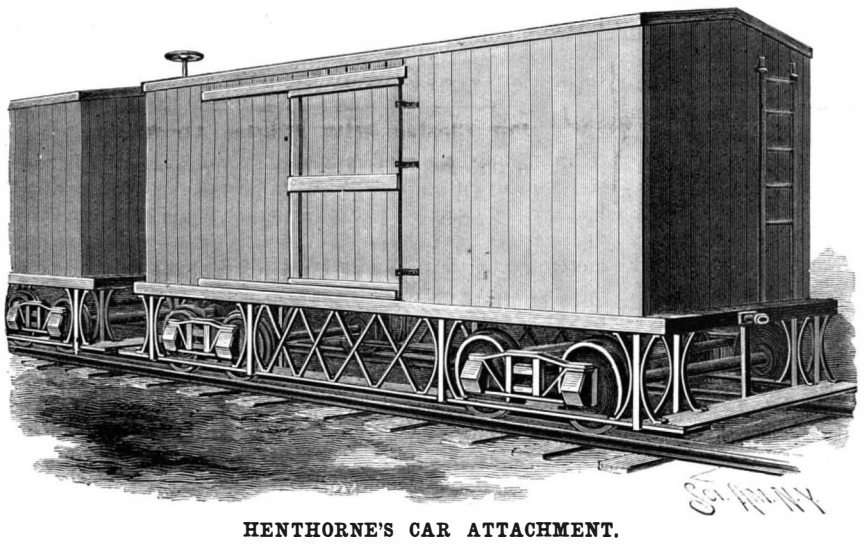
The Cleveland, O., *Leader* states that on April 4, at Washington, Oregon, a meteorite, weighing about 80 pounds, was excavated by workmen employed by the Rev. T. B. Collins, a former citizen of this place. Mr. Collins, at the request of a Chicago college, set men to work making the excavation.

Ever since the night of May 12, 1886, it has been the opinion of our citizens that at a spot beneath a large oak tree, near the corner of Main and Temple Streets, a meteoric stone was embedded in the earth. On that night a terrific electrical storm was raging, when citizens in that part of town who happened to be looking out of their windows saw an immense ball of fire traveling at an incredible speed toward the earth. It came crashing down through a large tree, struck the curbstone, and scattered portions of it fifty feet around. Window lights were broken in the houses throughout that locality, and the report sounded like the report from a big cannon. A large hole was made in the earth, but, strangely, it was left to this late day to discover the meteorite.

On April 4 the workmen discovered a soft streak in the earth, and followed it to the depth of nine feet. There, embedded in the earth, was a meteorite several feet in circumference and oblong in shape.

A RAILWAY CAR LIFE GUARD.

The life guard attachment shown in the illustration extends all round the car, so that there is no liability of a person getting under the wheels in falling at either side or end of a car, or between cars. The improvement has been patented by Mr. Henry Henthorne, of No. 345 North Fourth Street, Newark, O. The guard preferably extends to within about three inches of the rails, its bottom boards being located directly in the line of the car wheels, and extending somewhat beyond the car ends, where there are transverse end boards. In the bottom boards are openings of just sufficient size to accommodate the wheels, and the device is supported from the trucks by stirrups or hangers, strengthened by oppositely disposed braces. At each side of the car between the trucks is also a latticework, serving not only to prevent a person getting under the car between the trucks, but to give additional strength to the guard. The end members of the guard project far enough out from the end of the car to permit of their use by the trainmen as a step or platform in coupling cars, the guards of two cars provided with the improvement coming so close together that there will not be room for a person to fall between them.



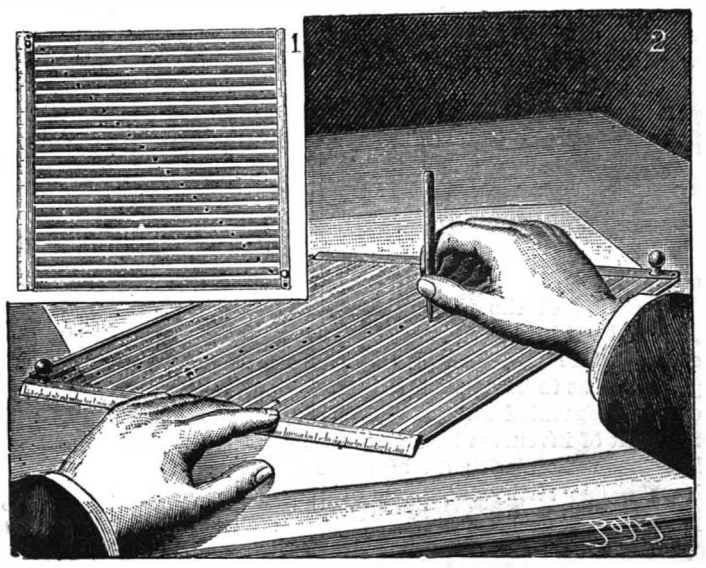
HENTHORNE'S CAR ATTACHMENT.

A Mosquito Exterminator.

The *Indian Medical Record* for March 16 says that a Bombay newspaper calls attention to the virtues of the castor oil plant as a means of protection against mosquitoes. In Egypt it is planted about houses to drive the insects away. In towns, a better plan is to have the young plants in pots, and bring them into the house for a day or two at a time, but they must not be kept too long in the shade, for the *Palma Christi* is a sun-loving plant. A writer is cited as saying that the mosquitoes are killed by a poison that they find on the lower side of the leaf, but it is stated that, if a dozen leaves are placed about a room that swarms with mosquitoes, they will disappear without leaving any dead ones lying about.

THE INSTANTANEOUS DIVIDER.

The instantaneous divider devised by Mr. Robert Personne, of Sennevoy, consists of a jointed parallelogram, in the interior of which, and parallel with one of its sides, are arranged small rules equally spaced and jointed at their extremities. Each rule contains, according to its longitudinal axis and to one of the diagonals of the parallelogram, a small numbered aperture designed for the passage of a pencil point, in order to mark the divisions. In order to divide any line into a certain number of equal parts, 17, for example, it suffices to place the zero of the instrument upon one of the extremities of the line, and to bring to the other extremity the aperture marked No. 17, and then to point off through all the apertures from 0 to 17. It is clear that, in cases in which it would not be possible to bring the aperture carrying the number chosen to the extremity of the line to be divided, it will suffice to replace such number by one of its multiples. For example: In order to divide a line of 20 centimeters into 3, it will be easy to point off 5, 10, 15, or else 4, 8, 12, etc. The principal figure in the engraving indicates the *modus operandi*.—*La Nature*.



INSTANTANEOUS DIVIDER.

1. View of the apparatus. 2. Method of using it.

Effects of Heat and Cold on Canned Foods.

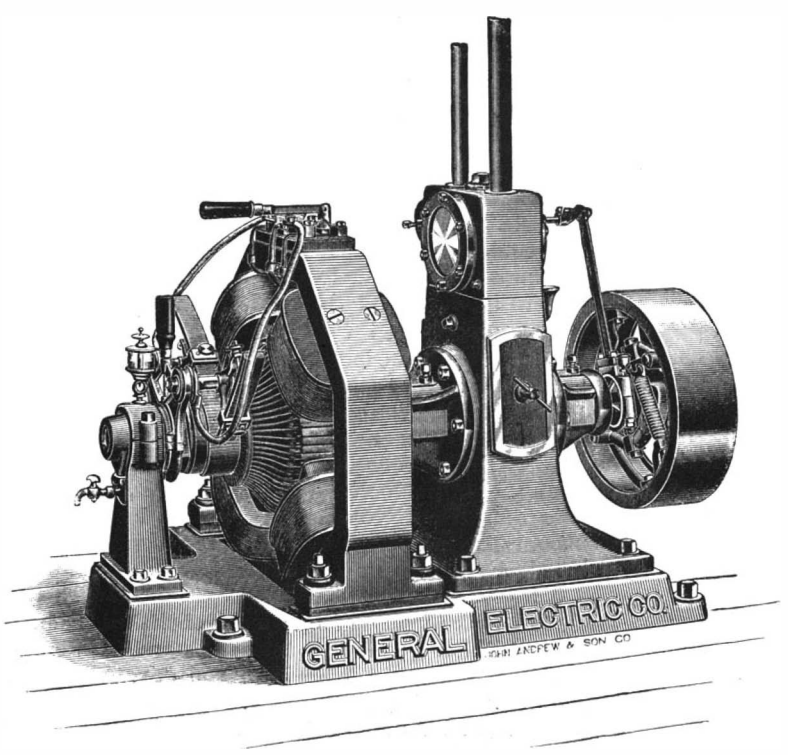
In a recent army circular, Adjutant-General Williams repeats the information heretofore published in the *American Grocer* concerning the keeping qualities of canned foods under exposure to extremes of heat and cold. General Greely, of Arctic fame, says:

"Apples, peaches, pears, rhubarb, green peas, green corn, onions, potatoes, and tomatoes were all subject [at Lady Franklin Bay] to extreme temperatures (over 60 degrees below zero), and were solid for months at a time. The second summer they thawed, the following winter froze solid again. All the articles named presented the same appearance as though freshly canned, and their flavor was as good when the last can was eaten as in the first month. It should be understood that these were first-class canned goods and from dealers of standing and reliability. Cranberry sauce, preserved damsons, preserved peaches, and fruit butters suffered certain changes from candying, etc., which detracted somewhat from their flavor, though not materially so. Dealers in such preserves predicted that such conditions and changes would occur. I had also canned turnips, squash, beets, and carrots, as well as pineapples, cherries, grapes, clams, shrimps, and crabs, which, although not subjected to such extreme temperatures as the foregoing, yet froze and thawed repeatedly without injury. No can of any kind except a few, say half a dozen of fruit butters, was ever burst by action of cold or heat."

Dr. Simson Pratt, of the British army, says:

"Taking my experience in India and the late Nile expedition, in which the test of tinned provisions was exceptionally severe, from continued exposuer to the powerful direct rays of the sun, I have found that tinned provisions, meat, and vegetables, put up separately, or combined in the form of soups, are practically undamageable by any climatic heat.

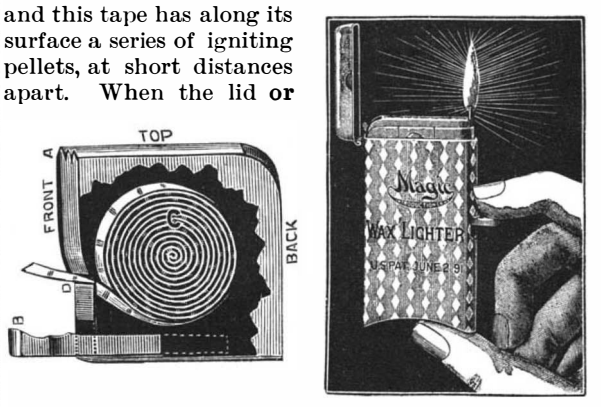
"The only class of provisions that, in my experience, suffers from great heat is that of uncooked articles, such as butter, cheese, and some forms of potted meats."



A SIMPLE AND COMPACT ENGINE AND DYNAMO.

THE MAGIC WAX LIGHTER.

The small, thin, self-lighting pocket device shown in the illustration is designed to be a good deal more of a convenience generally than the ordinary cigar lighters, although its use for such purpose is very obvious. A readily removable slide of the casing contains a roll of wax-coated tape, shown in one of the views, and this tape has along its surface a series of igniting pellets, at short distances apart. When the lid or cover is opened, by depressing the key at the side, the exposed wax taper is at the same time automatically lighted. Should light be desired for more than the brief period during which the exposed portion of the taper is burning, a further depression of the key, bringing forward a fresh surface, will effect the object, and this may be repeated as often as required. The construction is such that there is no possibility of chance ignition. The Magic Introduction Co., of No. 321 Broadway, New York City, is introducing this improvement, and the company has ready also a further novelty in the adaptation of the device to an umbrella or cane head.



THE MAGIC WAX LIGHTER.

A SIMPLE AND COMPACT ENGINE AND DYNAMO.

The direct coupled generator and engine, in one compact set, is, under conditions of restricted space and position, the ideal electrical plant. We illustrate a small, direct coupled generating set, recently perfected and manufactured by the General Electric Company, New York. It forms part of their display at the Columbian Exposition. As perfected, it represents the result of two years of careful practical experience.

For marine installations, where a separate engine is indispensable to drive the generator, these sets are especially adapted, being as cheap as, if not even less expensive than, belted plants, while they can be readily fitted to positions where a belt-driven dynamo and engine could not find a sufficiency of space. Compact and simple in arrangement, their suitability for small isolated plants in hotels and buildings where belting is objection-

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able is undeniable. Under exhaustive tests, the engine shows the highest possible economy obtainable from machines of this size; and its simplicity is such as to reduce the attention necessary to a minimum. The generator is of the familiar General Electric Company quadripolar type, compound wound, having a regulation automatic, within two per cent over the entire range from no load to full load. The commutators are cross connected, so that only two brushes, 90° apart, are used. The rheostat is of the new, iron frame, incombustible type. The engine and dynamo are both provided with self-oiling bearings. The sets are manufactured in 4, 8, 15, 30, and 50 kilowatt capacities.

Decisions Relating to Patents.

INVENTION.

The Circuit Court decides that letters patent No. 278,294, issued May 22, 1883, to Otto Thum, for a sheet of fly-paper partially covered with a sticky composition, the latter being surrounded by a margin of less adhesive material, so as to prevent it from spreading over the edges, and the third claim of letters patent No. 305,118, issued September 16, 1884, to the same person, covering the fly-paper with adhesive faces placed together, so as to be packed without folding, and adapted to be separated when ready for use, are not invalid for want of invention because plasters for the body had long been made with an adhesive margin surrounding the less sticky substance of the medicinal compound. 1.

The United States Supreme Court rules that claim 2 of letters patent No. 224,923, issued February 24, 1880, to Joseph W. Kenna, for a combined child's chair and carriage, consisting of an ordinary chair pivoted at the lower part of its front legs to the corresponding legs of a standard having four legs, and supported at the rear by a bail attached to a crosspiece by means of a spring catch, is void for want of invention, since practically all that the patentee accomplished was to take the Patten or Chichester chairs (covered respectively by patents issued September 3, 1878, and July 9, 1879) and apply to them the bail and catch of the prior "Pearl chair." 2.

It is held by the Circuit Court that claim 2 of reissued letters patent No. 10,021, issued January 31, 1882, to Andrew Saunders, for a pipe cutter, consisting of a stock, rotary cutters, antifriction rollers, arm, and feeding screw, is void for want of invention; for rotary cutters were well known substitutes for knife cutters, and every element in the combination had theretofore been patented in the same place, as is shown by the following patents: No. 52,715, to William S. Haworth, January 20, 1866; No. 65,066, to Theodore S. Foster, May 28, 1867; No. 67,530, to Henry Getty, August 6, 1867. 3.

The Circuit Court lays it down that letters patent No. 408,475, granted August 6, 1889, to Evan James Francis and Charles Banfield, for "a bottom for heating furnaces, formed of segregated masses, broken pieces, or fragments of non-combustible material having interstitial passages, and presenting a broken or uneven surface," disclose a patentable invention. 4.

In its rulings the Circuit Court says that letters patent No. 339,543, issued March 12, 1889, to William Mack, for improvements in opera-glass holders, possess no patentable invention, in so far as they merely provide for corrugations on the telescopic sections of his prior patent, No. 268,112, to prevent twisting, and for the substitution of a longitudinally forked attaching device for the original clutch. 5.

The Circuit Court decides that letters patent No. 274,941, issued April 3, 1883, to Isaac W. Heysinger, for a machine for inserting and clinching staples, are void as covering improvements obviously the result of mere mechanical skill. 6.

The Circuit Court rules that claims 4 and 7 of letters patent No. 268,112, issued November 28, 1882, to William Mack, for improvements in opera-glass holders, show patentable invention, and are valid as covering a detachable telescopic opera-glass holder having at the upper end a clutch or fastening device adapted to clasp the transverse bars or cylinder of an opera-glass. 7.

UTILITY.

It is held by the Circuit Court that when the existence of invention is doubtful, the fact of utility should have great weight in favor of the patent. 8.

COMBINATION.

The Circuit Court holds that letters patent No. 226,402, issued April 13, 1880, to Isaac W. Heysinger, for a device for filing and binding papers, if sustainable at all, must, in view of the prior state of the art, be limited strictly to the structure shown and described; and, as the first claim is for a filing clip composed of a clamping arm and a base, the former being provided with a heel, which holds the arm locked when open, the heel is an essential element, and there is no infringement where this is lacking. 9.

The Circuit Court decides that the fact that the claims of letters patent No. 219,208, issued September 2, 1879, to Charles F. Brush, for an electric lamp, purport to cover broadly all forms of mechanism constructed to separate the two or more sets of carbons dissimultaneously or successively, does not render the patent void as being for a function or result, since particular means are described in the specifications and referred to in the claims; and the patent covers such means or their substantial equivalents. 10.

The Circuit Court lays it down that letters patent No. 304,863, to Henry Root, for a track brake for railway cars, is not void as being a mere aggregation of old elements, for the brake consists of two toggle levers, one operating upon the other, which is attached to the shoe, thus achieving a new and useful result, sufficient, when aided by the presumption of novelty and utility arising from the issuance of the patent, to sustain the same. 11.

The first claim of letters patent No. 337,187, issued March 2, 1886, to Frank W. Mix, for a trunk lock, covers "a hasp plate and a lock plate, the adjacent edges of which are constructed to interlock with each other, in combination with a hasp hinged to the hasp plate, and provided on its free end with a lock, which is received in a cup or frame in the lock plate, substantially as set forth." It is held by the Circuit Court that, as all these elements were old, the claim is too broad to be sustained in view of the prior state of the art, as shown by the "Star" lock; the Jones patent, No. 44,869, November 1, 1864; the Uitting patent, No. 62,453, February 26, 1867; the Terry patent, No. 107,133, September 6, 1870; the Hillebrand & Wolfe patent, No. 120,067, October 17, 1871; the Haskell patent, No. 214,252, April 15, 1879; and the Crouch patent, No. 235,130, December 7, 1880. 12.

The Circuit Court decides that no limitation was placed upon the Brush patent by the fact that the inventor's claims, as first presented, were rejected as functional, and that the language was twice slightly changed, for the file wrapper shows that there was no change in the essential features of the claims, and that the Patent Office, after a contest, finally yielded to the patentee's views. 13.

1. Thum *v.* Andrews, 53 Federal Reporter, 84.
2. Derby *v.* Thompson, 13 Supreme Court Reporter, 181.
3. Saunders *v.* Allen, 53 Federal Reporter, 109.
4. Francis *v.* Kirkpatrick & Co., 52 Federal Reporter, 824.
5. Mack *v.* Spencer Optical Mfg. Co., 52 Federal Reporter, 819.
6. Philadelphia Novelty Mfg. Co. *v.* Weeks, 52 Federal Reporter, 816.
7. Mack *v.* Spencer Optical Mfg. Co., 52 Federal Reporter, 819.
8. Corbin Cabinet Lock Co. *v.* Eagle Lock Co., 52 Federal Reporter, 980.
9. Philadelphia Novelty Mfg. Co. *v.* Weeks, 52 Federal Reporter, 816.
10. Brush Electric Co. *v.* Electric Imp. Co., 52 Federal Reporter, 965.
11. Pacific Cable Ry. Co. *v.* Butte City St. Ry., 52 Federal Reporter, 863.
12. Corbin Cabinet Lock Co. *v.* Eagle Lock Co., 52 Federal Reporter, 980.
13. Brush Electric Co. *v.* Electric Imp. Co., 52 Federal Reporter, 965.

Habits of Thought.

Habit reigns as supreme in the region of thought as in that of action. We often see persons whose lines of thought run mainly in the same groove, be it art, or science, or politics, the accumulation of wealth, or the desire of fame. Their thoughts become as truly fixed habits as anything which they are accustomed to do with their hands. There are some people whose minds drift hither and thither with every passing wind of circumstance; for so long a time has such been their practice that it has become a mental habit. Others have acquired the habit of self-control, not only in their active deeds, but also in their silent thoughts. By frequent practice they have attained the power of concentrating their minds upon one subject for a time, and of turning it to another when they deem it advisable.

Again, if we could examine the ideas which men hold, we should perhaps be surprised to find how many of them are due to habit rather than logic. In childhood man took for granted whatever he heard expressed by those to whom he looked up with respect. Whenever he heard any of their ideas criticised by others he resented it, and clung firmly to them. These opinions have come to be settled habits of mind with him. He regards them as certainties, and looks with suspicion upon those who do not share them. Yet, if challenged to defend them, he is utterly at a loss. They are his only by adoption; he has never earned the right to call them truly his own by the hard mental work of investigation.

This is the history of many of our most cherished notions, the foundation on which thousands stand in politics, in science, in the problems of the day, in social observance, in ethics, in theology. This practice of thinking from habit, if universal, would put an end to all progress. Happily, there are always some men and women who are resisting this tendency —the leaders of public opinion, the pioneers in the march of intellectual progress. Their effort should be, however, less to impress their own views upon other minds than to help every man to form his own ideas in an intelligent way.—*Phil. Ledger.*

The Carrier Pigeon.

JOSEF V. PLEYEL.

Of late years the interest in carrier pigeons has been very considerably enhanced. Belgium takes the lead, but the other countries are not far behind. The facility with which the carrier pigeon determines its course is as yet unexplained. To attribute this knowledge of direction to instinct is merely a confession of ignorance. It is much rather sight, reflection, and sensation which guide the carrier pigeon on its course, and rarely guide it wrong. The same faculty is possessed by all migratory birds. To form an intelligent conception of this faculty, we must assume either a special sense or a delicate sensitiveness to atmospheric currents. Experiments by balloonists have shown that pigeons are incapable of flying at any great height. Birds thrown out at 6,000 meters fell like dead, and even at the moderate height of 300 meters pigeons liberated by the balloonist Gaston Tissandier approached the earth in a spiral course. It is evident, hence, that they are not guided wholly by sight. To bring a point 300 miles distant within the range of vision, it would be necessary to ascend nearly 20,000 meters. The carrier pigeon, starting on such a journey, must consequently start with faith in the unseen.

As regards the speed of flight of carrier pigeons, there is considerable divergence of opinion. The Belgian birds are admittedly the best, and the greatest achieved speed of a Belgian bird is given as 150 kilometers (over ninety-five miles) within the hour. In favorable weather a good bird will cover thirty to thirty-five miles in an hour. The greater the distance, the smaller the probability of the prompt return of the bird. At a distance of say a hundred miles almost all birds return safely if the weather is favorable, but at distances of four or five hundred miles it is impossible to reckon confidently on the bird's return. It appears curious, but it is a well established fact that as the bird nears its home its speed is accelerated.

The question has frequently been raised as to whether the male or female pigeon is the better for racing contests. Practically there is nothing to choose between them when both are in condition, but a laying female should never be taken for the sport.

The carrier pigeon is not, as many suppose, a distinct variety. All domestic pigeons are presumably descended from the blue-rock pigeon, and all are more or less suited to the purpose. The common pigeon is not used, for, although a rapid flier for short distances, he has no great staying powers.

One of the best pigeons for the purpose is the tumbler (*Columba gyratrise*), whose sense or sensation of direction is very strongly developed, and who rarely loses his way. The tumbler flies higher than most birds of the genus, and will continue circling in the air for hours. He has all the necessary staying power for long flight, and a great love of his home. Still, many of these birds leave much to be desired. In the first place, they are likely to waste time before setting out on their return; again, they are liable to fall victims to birds of prey; and, lastly, they are especially liable to diseases of the eye, which frequently result even in total loss of sight. Another bird of equal speed and endurance is the Persian "carrier."

In the first year the trainer rarely lets the test exceed from 60 to 90 miles; the following year the distance may be extended to 250 miles; and in the third year, when the bird is at the height of his powers, the limit may be extended to 350 or 400 miles.

In the last year of training, the first flight is from 120 to 130 miles, terminating in a contest which usually extends to about 300 miles. The longest contests are from 400 to 700 miles. Before entering a bird for the contest it should be carefully examined as to its fitness, and the feet cleaned, washed, dried, and oiled. Some trainers start their birds with empty crops, with the idea that it will make them more eager to get home. This is a great mistake. The famished bird is liable to be exhausted by long-sustained effort.—*Der Stein der Weisen; Literary Digest.*

Gigantic Icebergs.

The mail from the Falkland Islands brings the intelligence that the Dundee whaler Polar Star arrived at Stanley Harbor from the Antarctic season February 17. The whaling in the Antarctic seas had up to that time proved a failure with all the ships that went out. There were plenty of whales of the finner and humpback kinds, but not of the Greenland kind. There were too many grampuses for whales to be at all plentiful. Seals are very numerous, and there are also many sea lions to be got on the ice. Nothing unusual to Arctic navigators was seen except some icebergs of enormous size. One of them was fifty miles long and several others from fifteen to twenty miles long.

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WINBY'S EXPRESS LOCOMOTIVE AT THE COLUMBIAN EXPOSITION.

(*Continued from first page.*)

Sanding gear—Gresham and Craven's steam sanding gear is fitted to the four driving wheels.
Cylinder cock gear—Hawthorn's steam-worked drain valves working simultaneously.
Reversing gear—Steam and hand coupled together, and working all valve gear simultaneously.
Injectors—Two No. 10 Holden and Brooke's "1892" patent injectors.
Springs—All the bearing springs and the bogie controlling springs of Timmis' latest section.

Engine.—Cylinders (inside).	
Diameter	17 in.
Stroke	22 in.
Center to center of cylinders	2 ft. ½ in.
Center of cylinder to center of valve spindle	1 ft. 2 in.
Ports on top of cylinder.	
Diameter of piston rod	3¼ in.
Valve motion (inside)—	
Ordinary link.	
Slide bars, number per cylinder	4
Slide bars, width	3 in.
Crosshead (forged solid with piston rod).	
Length of shoe	1 ft. 1 in.
Cylinders (inside)—	
Diameter	16½ in.
Stroke	24 in.
Center to center of cylinder	6 ft. 5 in.
Center of cylinder to center of valve spindle	1 ft. 3 in.
Ports on top of cylinder.	
Diameter of piston rod	3¼ in.
Length of piston rod	9 ft. 8⅛ in.
Valve motion (outside)—	
Joy's patent.	
Slide bars, number per cylinder (in one steel casting)	2
Slide bars, width	6 in.
Crosshead (forged solid with piston rod).	
Length of shoe	1 ft. 3 in.
All piston rods and valve spindles have metallic packing.	
Wheels (cast steel centers)—	
Bogie, diameter on tread	4 ft.
Driving, diameter on tread	7 ft. 6 in.
Axles (steel)—	
Bogie.	
Diameter of journals	6 in.
Length of journals	12 in.
Centers of bearings	3 ft 4⅛ in.
Driving inside crank—	
Diameter of journals	8½ in.
Length of journals	9 in.
Diameter of crank bearing	8½ in.
Length of crank bearing	4½ in.
Cranks hooped and pinned.	
Driving outside straight—	
Diameter of journals	8½ in.
Length of journals	10¼ in.
Crank pin—	
Diameter	5 in.
Length	6 in.
Frames (steel)—	
From front end to center of bogie	5 ft. 3 in.
From center of bogie to center of driving wheel	9 ft. 8 in.
From center of driving wheel to center of trailing wheel	11 ft. 4½ in.
From center of trailing wheel to end of frame	4 ft. 4 in.
Total length of frame	30 ft. 7½ in.
Thickness of frames	1⅛ in.
Between frames	4 ft. 1⅛ in.
Between frames at front end	3 ft. 9 in.
Wheel base—	
Bogie wheel base	5 ft. 3 in.
Fixed wheel base	11 ft. 4½ in.
Total wheel base	23 ft. 8 in.

Mr. Winby has here aimed to design an engine which, while not intended to attain a higher maximum of speed than ordinary engines, should be capable of traveling at a much higher mean speed. To do this it was obviously necessary to increase largely the tractive power of the engine. It may here be stated that an ordinary modern express—say, for instance, Mr. S. Johnson's latest—has four wheels coupled, 7 feet diameter, and inside cylinders 18½ inches by 26 inches, giving a tractive effort of 106 per pound of steam, while Mr. Winby's engine is capable of exerting a tractive force of 143 per pound of steam, with wheels 6 inches larger in diameter.

This design has two pairs of cylinders, an inside pair, 17 inches by 22 inches, being coupled to the leading drivers in the usual manner, and an outside pair, 16½ inches by 24 inches, being coupled to the trailing drivers; there being no coupling rods, each pair of wheels may go as it pleases, and there is no necessity to pinch the fire box in any way.

Terms of Water Measurement for Mining, Irrigation and Mill Power.

BY G. D. HISCOX, M.E.

The designation of the terms of water measurement seems to be somewhat misunderstood, or has become misleading in many parts of the United States, from the manner in which a primitive custom of water measurement has been adopted in different localities and afterward in some of its forms been made legal by the courts.

Differences in elevation above the sea and the latitude make a slight difference in the flow of water by gravity for a length of time, too small for practical consideration, but just enough for a legal quibble when water measure is referred to the courts.

Variation in the form of the orifice varies the actual delivery per square inch of orifice, and with all the conditions of variation in head, form of orifice, elevation of locality, latitude and dissimilarity in the lengths of orifice, there is found a variation in the accepted unit flow through a square inch of orifice of over half a cubic foot per second.

In this view the *miner's inch* of water used in the early days of California mining has become a standard of varying proportions in different localities, most perplexing as a definite and legal measure; so that the nominal miner's inch may deliver any quantity from 1·20 to 1·78 cubic feet of water per minute.

The largest volume for a miner's inch is the measure used at Smartville, Yuba County, Cal., called the *Smartville inch*, is derived from a horizontal rectangular orifice 4 inches in depth, through a 2 inch plank, under a head of 9 inches from the center of the orifice, and of the required width for the total flow, this being equal to 1·78 cubic feet per minute per square inch of orifice.

The miner's inch of the Park Canal and Mining Co., El Dorado County, Cal., is equal to 1·45 cubic feet per minute, with an orifice 2 inches deep through a 1½ inch plank—head 6 inches above center of orifice—this being the rating of several ditch companies in California.

By a series of experiments at Columbia Hill, Cal., lat. 39°, 2,900 feet above the sea, 1·5744 cubic feet per square inch per minute was assigned as a miner's inch, this being the flow per square inch through a rectangular slit 50 inches long, 2 inches deep, equal to 100 square inches, under a head of 7 inches from the center of the slit; this being also the rate with the North Bloomfield, Milton and La Grange Ditch Companies.

In other parts of California 50 miner's inches are rated at 60 cubic feet of water, or 1·20 cubic feet per miner's inch. The statutory or legal miner's inch of California is equal to a flow of 1·394 cubic feet per minute, and is defined as the flow through a square orifice 1 inch in depth by 1 inch in width through a 1 inch plank, under a head of 4½ inches above the center of the orifice.

In Colorado, previous to statutory regulations and still in use by agreement, 40 miner's inches are reckoned at 60 cubic feet, or 1·50 cubic feet per square inch of orifice under a head of 6 inches above the orifice in the bottom of the delivery box, the stream falling vertically, the actual flow being 1·556 cubic feet per minute.

The statutes of Colorado now provide that "water sold by the inch by any individual or corporation shall be measured as follows, to wit: Every inch shall be considered equal to an inch square orifice, under a 5 inch pressure, and a 5 inch pressure shall be from the top of the orifice of the box, put into the banks of the ditch to the surface of the water."

The practice much in use in Montana is to deliver the water through a horizontal slit 1 inch in depth, of sufficient length for the required supply, under a head of 4 inches above the center of the slit, and is equal to a flow of 1·25 cubic feet per minute per square inch of orifice.

Six and a half inches head above the center of a 1 inch square orifice, or a long horizontal gate 1 inch in depth, is becoming the more usual practice in California, where the miner's inch originated, and will no doubt come into general use as the most satisfactory working condition of water supply for mining and irrigation purposes.

From experiments of the Pelton Water Wheel Co., the relation of flow under various heads and increasing widths of slot, with a uniform thickness of plank and distance of orifice from the bottom of flume, becomes interesting, in view of the varying practices in different States and localities. With a square orifice 2 inches in depth, 4 inches wide, a 5 inch head above the center of the orifice gave a flow of 1·348 cubic feet per minute; 6 inch head, 1·473 cubic feet; 7 inch head, 1·589 cubic feet per minute per square inch of orifice. By lengthening the orifice horizontally the flow increased in quantity per square inch of orifice, owing to the increase of area relative to the increase of perimeter; so that at 16 inches in width, 5 inch head, flow 1·365; 6 inch head, 1·489; 7 inch head, 1·60 cubic feet per square inch of orifice.

For the purposes of irrigation, the irrigating duty of water takes its base of computation from the flow per second or minute; but as this is not a constant quantity for different localities, owing to variation in the value of the miner's inch, the acre duty will be an uncertainty until some general law fixing a uniform standard of measure or detail, as to head and area to constitute a unit of measure, is made to extend over the different States and Territories requiring a system of irrigation.

As an irrigation term the "duty of water" means the area of land upon which a definite volume of water, applied during a given period, will successfully raise crops.

In Utah, where irrigation laws have largely covered the details of water rights, the "unit" of water measurement is designated as one cubic foot of water per second, called the "second foot," is the standard of expression for water service for irrigation, and is equal to 86,400 cubic feet per day. The "acre foot" is the equivalent of one acre covered one foot deep, or 43,560 cubic feet, to which is added the time requirement.

In Utah the "second foot" is equal to two "acre feet" per day—"60 acre feet" per month; 100 California inches equal 4 acre feet per day; and 100 Colorado inches equal 5⅓ acre feet per day.

The "second foot" is becoming popular throughout the Western States and Territories, from its definiteness of meaning and understanding, and with which there is little chance for technical quibble.

The measurement of water for power in the eastern portion of the United States is the "inch," under a stated head. The "inch" or "inches," meaning the number of square inches opening in a gate, or orifice, leading to a water wheel under some specified head.

The practice varies largely in different States. In New England, the water power companies have specific measures of gate opening, from one foot head upward, and also rate by the theoretical horse power for any form of flow.

Where no specified head is named, a 4 feet head from the center of the gate orifice to the surface of the water in the flume has become legalized in some of the States by statute or court decision; the height or head above or below the statutory 4 feet being reckoned by its relation to the unit, in power-producing effect.

This is made the basis in water power leases in Wisconsin from the time of the earliest leases in that State.

In some cases the actual heads are named. The valuation of variation in the head below and above 4 feet, when named as a unit, has been a cause of legal contention in several States, and in Wisconsin it has been fairly defined that the power derived from a unit orifice varies proportionately with the variation of the head, and that the area for a given power varies inversely as the square roots of the heads, less the proportion of increased head and the reverse for decreased head. The following table shows the relation of area in percentage of the unit area for various heads:

Head in Feet.	Inverse Velocity Ratio. $\frac{\sqrt{4}}{\sqrt{\text{Head.}}}$	Inverse Ratio of Area Due to Head.	Proportional Area of Orifice for Varying Head.
3	1·155	+ 0 25	= 1·443
4	1·000	Unit, 0·00	= 1·000
5	0·8944	— 0·1788	= 0·7156
6	0·8162	— 0·2721	= 0·5441
7	0·7561	— 0·3240	= 0·4321
8	0·7036	— 0·3518	= 0·3518
9	0·6666	— 0·3699	= 0·2969

Foul Water Main.

Mr. James Duane has described in a paper read before the American Society of Civil Engineers the effect of tuberculation on the delivery of a 48-inch water main. The author remarks that authentic data relating to the effect of tuberculation on the discharging capacity of water mains are rare, and when obtainable are correspondingly valuable. He has had an unusually favorable opportunity for observing the loss of head due to this cause in a large water main, and comparing it with that in a perfectly clean coated new main discharging under the same conditions; both being parallel mains of the Croton water supply system of New York. One line of mains was laid as clean castings, just as they came from the sand. The result was that in seven years the inside was discovered to be tuberculated to a surprising extent. All the lumps were of the same general shape, which was that of a rough frustum of a cone, with a height of one-half or one-third the width of the base, and a roughly flattened top. The largest were at the bottom of the pipe and the smallest at the top. The greatest projection of the lumps was about one inch; and they were so thick as to completely cover the interior surface of the pipe. As compared with the clean tar-coated pipe, the discharging capacity of these corroded mains showed a reduction of about 30 per cent. It was also observed by Mr. Duane that, having reached a certain stage in corrosion, a water pipe does not get worse with age. He regards a properly applied coating of tar composition as giving absolute protection against tuberculation, and cites in support of this belief the fact of a 48-inch main so treated showing as high a coefficient of duty after eleven years' service as when first brought into use.

Tin from Tin Scrap.

By T. Twynam.—The scrap is coated with a film of chloride of calcium or similar fusible salt and heated to redness. It is then cooled by plunging in water, when a scale falls which contains all the tin and leaves the iron practically clean and suitable for many metallurgical processes. The insoluble scale may be smelted direct for tin after mixing with carbon and siliceous matter, or it may be heated with sufficient acid, preferably hydrochloric, to dissolve out the iron, leaving the oxide of tin in a nearly pure state, or the tin may be recovered as a soluble stannate after fusion of the scale with alkali.

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THE ELECTRIC RAILWAY BETWEEN CHICAGO AND ST. LOUIS.

Among other wonderful novelties promised us in connection with the World's Columbian Exposition is an electric railway of high speed between Chicago and St. Louis. The projectors expected to have the work completed in time to carry passengers to the great Fair; but they have been disappointed, and although it was announced some time ago that the roadbed was under contract and a considerable portion already constructed, still, for some reason or other, the enterprise has remained very quiet of late and we fear has come to a halt. We are indebted for the following description of the novel system and the great expectations of the projectors to the *Graphic*, of Chicago.

The Chicago & St. Louis Electric Railway Company, a corporation organized under the laws of Illinois "for the purpose of constructing, maintaining and operating a complete electric railway system between the cities of Chicago and St. Louis, with suitable and necessary spurs and branches connecting with the towns and cities along said road, for the accommodation of local and through passenger and high-class freight, express and mail traffic, and for the further purpose of supplying citizens and cities on the route of the road with light, heat and power, for State, county, municipal, domestic, farming, manufacturing and other purposes," has perfected plans for the construction of an electric line which will satisfy the most zealous enthusiasts on the subject of rapid and cheap transportation.

The patents under which the new system will be operated were applied for by Dr. Wellington Adams in 1883, and granted to a Missouri company known as the Adams Electric Company in 1884, and were the first patents ever issued covering the essential elements of an electric railway. These patents were subsequently assigned to the Adams Electric Railway Company, and later conveyed to the Chicago & St. Louis Electric Railway Company.

The line between the two cities will be divided into 25 sections of 10 miles each, and will be operated from power stations located at coal mines belonging to the company along the route. The electric coach or car to be run is a long, low, compactly and strongly built car of very light weight; its weight being an important feature in the economy of operation. The car has two pairs of driving wheels, each of which is driven by a separate and distinct electric motor. The entire weight of the car, with its passengers, and of the two motors comes upon these two pairs of driving wheels, and consequently is all serviceable for adhesion between the rails and the wheels, through the agency of which the car is propelled. The driving wheels are 6 feet in diameter, and are estimated as capable of making a minimum of 500 revolutions a minute, which would give the car a speed of more than 100 miles an hour. The large size of the driving wheels makes the revolution of the axle only about the same speed as that of the axles under an ordinary passenger coach moving at the rate of 50 miles an hour, and therefore the friction will be no greater. The axles of the electric car also turn on roller bearings which do not require the use of oil.

The cars are to be run one section apart, and no current will be permitted to flow in the intermediate section, making it wholly impossible that cars should come within less than 10 miles of each other, and preventing absolutely the possibility of collisions. The top of the electric car will be only 9 feet from the rail, which is 3 feet lower than the ordinary street car. The center of gravity is thus brought very low, and quite near to the track, practically eliminating the possibilities of the car jumping the track. The front of the car is wedge shaped, and will cut the atmosphere in a way to very materially decrease the atmospheric resistance. The motorman stands just behind this wedge-like nose, and between his department and the rear wheels is the passenger compartment. After the passenger coach is a separate compartment for mail and high class express matter. An overhead electric construction will be used, consisting of central poles and cross arms, with a trolley wire running along the side of the car. Motors operating under this system require no commutators or brushes, and may be so constructed as to be water and fire proof.

The line of the road will be practically straight, and there will be no railroad or country road crossings at grade or on a level with its own line. The tracks of the electric road will be elevated above the crossing tracks of other railroads by means of iron bridges, and the country roads will be thrown up over the track of the electric road by means of wooden bridges.

It is estimated that there will be about 250 of the latter to construct and 17 of the former. This will give the line a roadway completely protected from interruptions of all kinds, and insure against the occurrence of the many accidents common to other railways. There will not be a frog, a switch nor a drawbridge on the entire line.

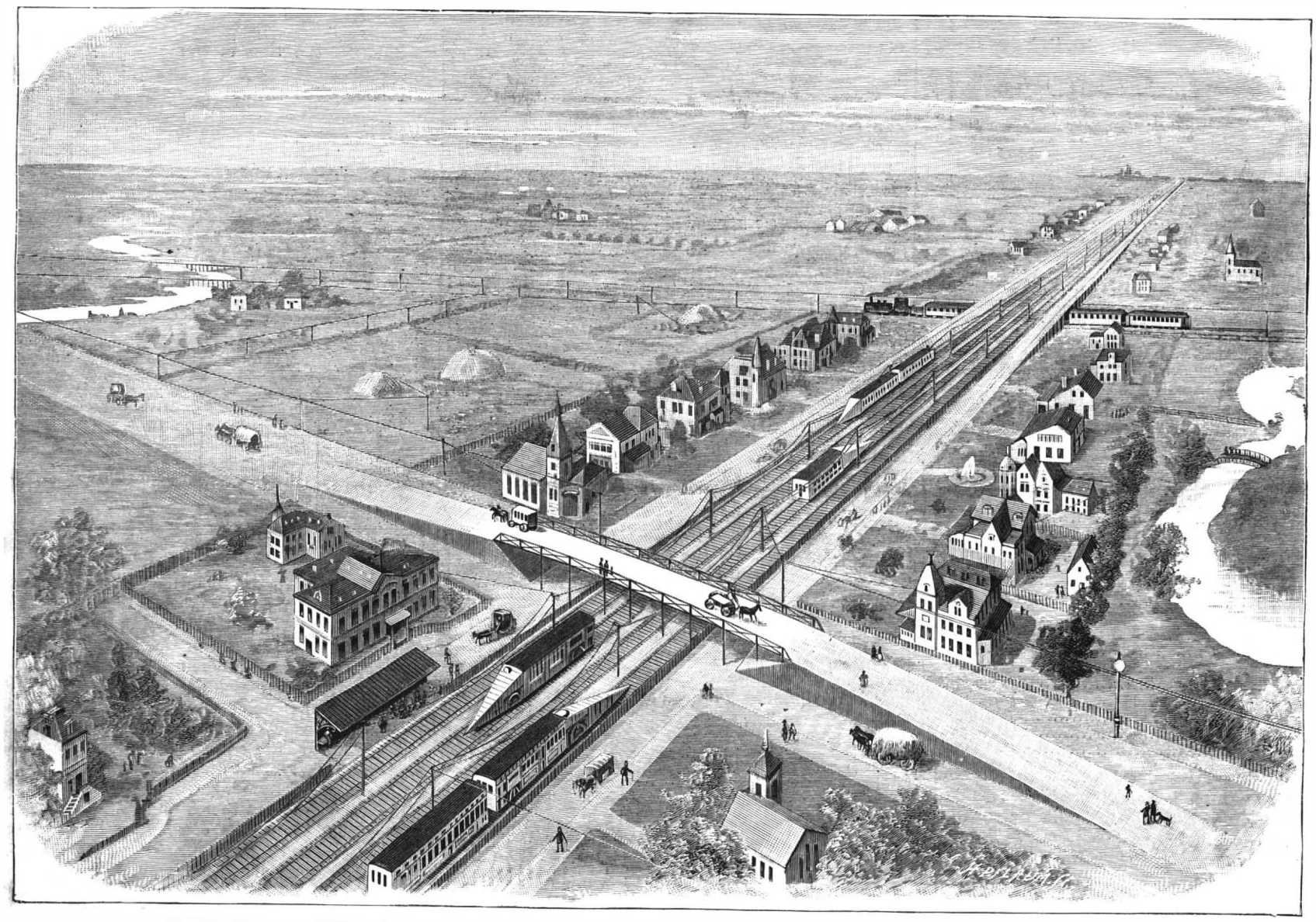
The weight of the whole car, with its equipment, will not exceed 15 tons, eliminating the great difficulty encountered by steam railroads, which have so large an amount of dead weight to draw. In the case of these roads there are hauled 19 tons of non-paying weight for each ton of paying passenger weight. In the electric road this will be reduced to the ratio of 1 to 5.

It is thought that two power houses may be sufficient to provide the necessary force, but more will be erected if required. The possibility of transmitting power electrically over long distances with economy was demonstrated at the last Frankfort Exposition, where 300 horse power was sent by electricity over a distance of 108 miles with an efficiency of 75 per cent.

The road will have double tracks at first, but the line will eventually build four tracks—two light-weight outside tracks for local traffic and high class freight and two heavy-weight inner tracks to be used exclusively for through passenger traffic, mail and express. The standard schedule time of through trains will be 100 miles an hour, the trip from Chicago to St. Louis being made in two hours and thirty minutes. No passenger trains, it is said, will be run at night, or at least not later than 9:30 P. M.; and the track will be employed during these hours by cars carrying freight, mail and express matter. The cars will be lighted and warmed by electricity, and will be provided with all the comforts of the modern car. A through train will be run every hour, or oftener, as may be required, and accommodation trains will be run every half hour, as soon as tracks are provided for this purpose. The line of the road will be illuminated by incandescent electric lamps for one mile ahead and one mile behind every car while running at night.

The economy proposed in the matter of fuel is an important feature. The company has secured coal lands suitable for its purposes, and will operate its own mines by means of electric mining locomotives, electric drills and electric cutters, largely cheapening the cost of mining the coal. The good coal will be sold and the waste, dust or slack, which is a complete loss under the present methods of mining, will be utilized in the engines which develop the power for operating the road and the mines.

The entire line of the road has been surveyed and the location definitely settled. A large percentage of the right of way has been acquired, and valuable terminal facilities and entrances have been secured in both Chicago and St. Louis. At the latter city the road will cross the Mississippi River on the Merchants' Bridge and run over the new elevated structure of the Merchants' Terminal railway into the Union Depot. At Chicago it will enter the city over the elevated structure now being built for the Chicago Elevated Terminal Railway Company, and run into its station at State and Twelfth Streets. Work was recently begun at Edinburg, Ill., where power house No. 1 of the company is located, and is being actively prosecuted under supervision of Chief Engineer Hughes. Over 8 miles have been completed since work was commenced, and they have every assurance that the road will be completed and carrying passengers during the World's Fair in 1893. The new electric line, it is claimed, will afford a much needed link between the large number



BIRD'S EYE VIEW OF THE CHICAGO AND ST. LOUIS ELECTRIC RAILWAY AND BOULEVARD.

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of Southern and Western railway lines centering in St. Louis and the Northern and Eastern lines centering in Chicago, and will do a very large proportion of the passenger, express and mail traffic of these systems between the two cities. The enterprise is backed by some of St. Louis' leading financiers."

Since the above was written there must have been important changes in the expectations and means of the company, for we cannot learn that any definite progress in the work has been realized.

MANUFACTURE OF MACARONI.

Our illustrations are taken from the plant of the Columbia Macaroni Manufacturing Company, New York City. Macaroni is a preparation of wheat originally peculiar to Italy, in which country it is an article of food of national importance. The same substance in different forms is known as vermicelli, spaghetti, Italian pastes, taglioni, etc. These substances are prepared from hard, semi-translucent varieties of wheat. Hard wheats are richer in gluten than the soft and tender wheats. These wheat preparations styled macaroni are met with in various forms, such as fine thin threads called vermicelli, from its thread-worm-like appearance, thin sticks and pipes, stars, disks, ribbons, tubes, etc. In the manufacture of macaroni about 100 pounds of semolina or granulated wheat is first put into a circular iron mixing machine 3 feet in depth and 2 feet in diameter. A quantity of boiling water is then added and the substance mixed up into a stiff dough by a revolving shaft armed with circular teeth which runs down through the center of the machine. The dough is then taken out and placed in a circular wooden rolling machine, 3 feet in height and 8 feet in diameter, over which for 40 minutes travels a revolving granite roller 5 feet in diameter, 18 inches in width, weighing 3 tons. After the dough has been thoroughly rolled and pressed, it is placed in a kneading machine. A layer of dough about 4 inches in thickness and about 8 inches in width is placed around the outer edge of a circular revolving pan 6 feet in diameter and 18 inches deep. Attached to the framework of the machine across the center of the pan are two loose cone-shaped gearing wheels. As the pan revolves around, the dough is passed under the cone-shaped wheels, which in turn revolve, burying their teeth into the dough. This operation continues about 20 minutes, thoroughly mixing and kneading the substance. It is then placed in the cylinders of the macaroni press. These cylinders are about 2½ feet in length and about 15 inches in diameter, on the inside of which, resting on a flange at the bottom, is a copper mould. These moulds are about 1 inch thick and perforated with holes through which the pipes of macaroni are pressed. The pipes are made hollow by means of a circular piece of copper held in place by a pin running across the center of the hole on the inner side of the mould. As the dough is pressed over the pins it divides in the center and unites itself again as it passes out of the mould. About 100 pounds of dough is placed in the cylinders at a time, which is pressed out through the moulds by means of an accurately fitting plunger or piston. One thousand pounds pressure is used, the cylinder emptying itself in about 45 minutes. As the pipes of macaroni pass out of the mould they are cut off into 10 foot lengths and taken to the cutting table, where they are recut into small lengths for drying. The macaroni is then placed on pasteboard and racked away for eight days to dry, in a temperature of 80 degrees, when it is placed in boxes and is ready for market. The company employs about 125 Italian hands and turns out about 3,500,000 pounds yearly.

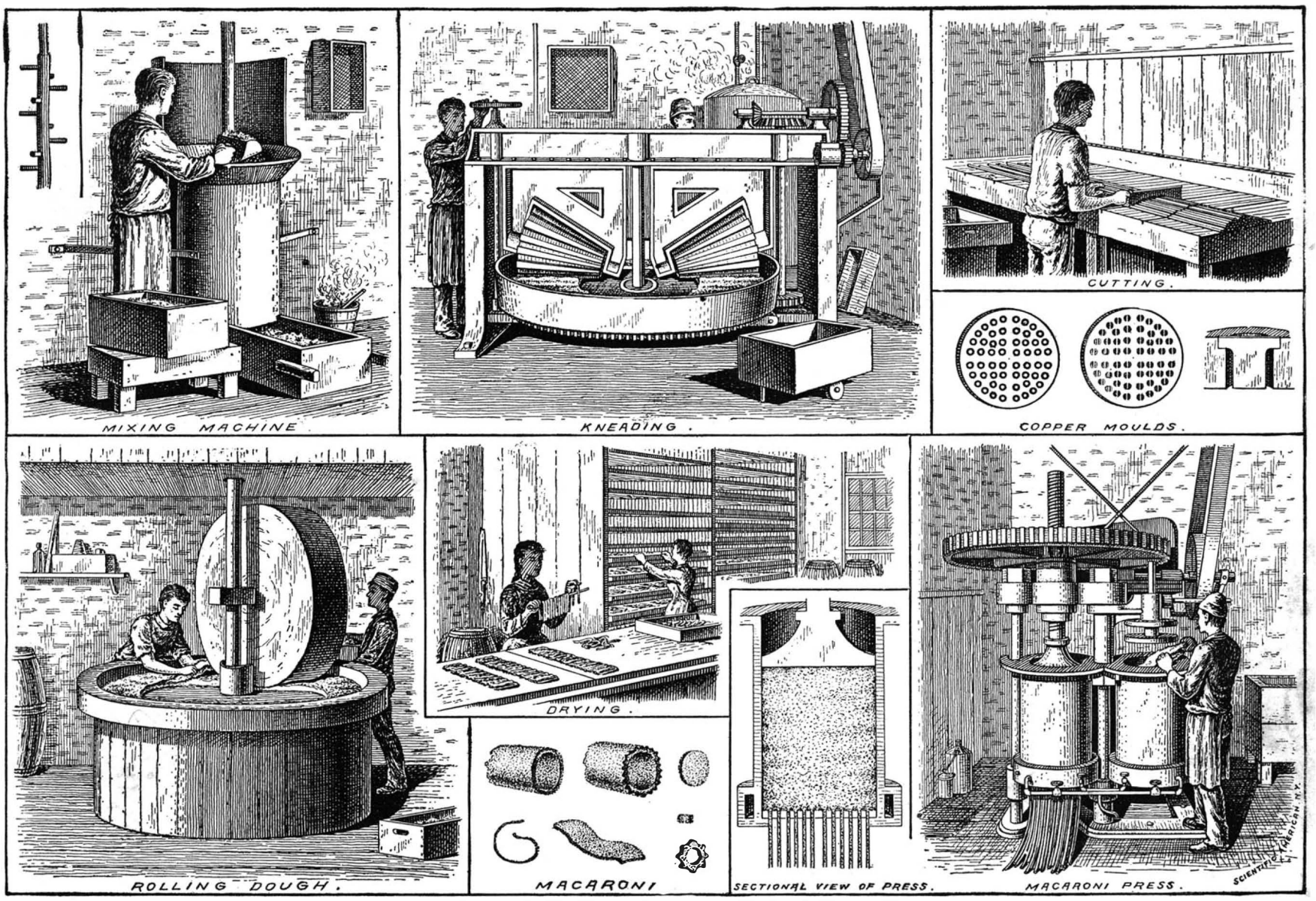
Having thus described the method of manufacturing macaroni in New York, we will now give an account of the way the article is made by hand in Italy.

The hardest and flintiest varieties of wheat are selected, first washed and then thoroughly dried in the sun. This wheat is then coarsely ground and run through a revolving sieve to separate the starch from the bran and flinty portions. It is then successively passed through a series of six hand sieves, each a little finer than the preceding, for the purpose of separating the flinty portions from the bran. This apparently simple process requires considerable skill, and a certain knack which it takes time to acquire. The motion which is given to the sieves by the sifters is half rotary and half up and down, with an indescribable side motion, which can only be characterized as a "boomerang," for it throws the mass which is being sifted in an opposite direction to that taken by the sieve. Every few minutes each sifter pauses and skims off the bran which has worked to the top and center of the sieve, and after these various manipulations there remains a clean, flinty farina, known as semolina. This is then mixed with warm water into a stiff dough, and this dough is thoroughly kneaded by means of a long prism-like, hardwood lever, so adjusted that the spring of the timber may be utilized in alternately raising and depressing it upon the mass of dough, which is then pressed and kneaded into the required consistency. It is rather amusing to see two or three men sitting on the end of this lever and bobbing up and down so as to throw their weight at one instant on the lever, bringing it down into the dough, and then allowing it to spring up again, in order that it may be brought down in a new place.

After it has been thus mixed and kneaded for about an hour, the dough is put into presses with perforated bottoms, and, pressure being applied, it comes out through these holes in the shape known to us as macaroni. At this stage of the process it is, of course, soft and flexible, and in order to keep the various little strings of dough from sticking together, it is constantly fanned by a boy, so that the current of air thus made may slightly dry the outside of the strings and prevent them from adhering. It is then cut off and hung on racks or frames made of bamboo to dry. As it hangs on the frames the different pieces are of unequal length, and a boy passes rapidly over them, wringing off the longer ends to make them uniform. The drying has to be done in the shade and in a place not exposed to the wind; for, if dried too quickly, or if the slender pieces were blown against one another, they would be apt to break. When sufficiently dry it is removed from the frames and packed in boxes such as are familiar to all grocers.

The different sizes are made by changing the movable bottoms of the press and employing different sized perforations. Each of these perforated holes has a core or center around which the dough has to pass, and this produces the hollow which is a characteristic of the macaroni. The reason of this arrangement is, if the macaroni is made solid, it would take very long to dry when hung upon racks, and also when dried it would be very difficult to cook it without a great deal of boiling, and impossible to do so uniformly. So important is this considered, and so defective do the Italians regard the product if not thus perforated, that a proverb has arisen in Italy to the effect that "A foolish person is like macaroni without any hole in it."

Vermicelli is made from the same material and in the same way as macaroni, except that it is not hollow, it being so small that it is neither practicable nor necessary to make it so.



THE MANUFACTURE OF MACARONI, NEW YORK.

Photographic Work in France and Belgium.

M. De Saint Florent has communicated to the French Photographic Society a method of printing with salts of iron, by which he says colors may be faintly reproduced—the red, yellow, and green being more distinct than the violet and blue. A gelatino-bromide plate is taken, and the silver is removed from the film by fixation in the hyposulphite bath, and, after washing, the plate is dried. The film is now sensitized in the following:

Water	100 parts.
Ferric chloride	10 "
Tartaric acid	5 "

After rinsing, the plate is dried and exposed for rather a long time under a colored original—as, for example, colored glasses or gelatines. It is next washed with warm water, by which some of the more soluble parts of the gelatine are removed, and it is finally dried.

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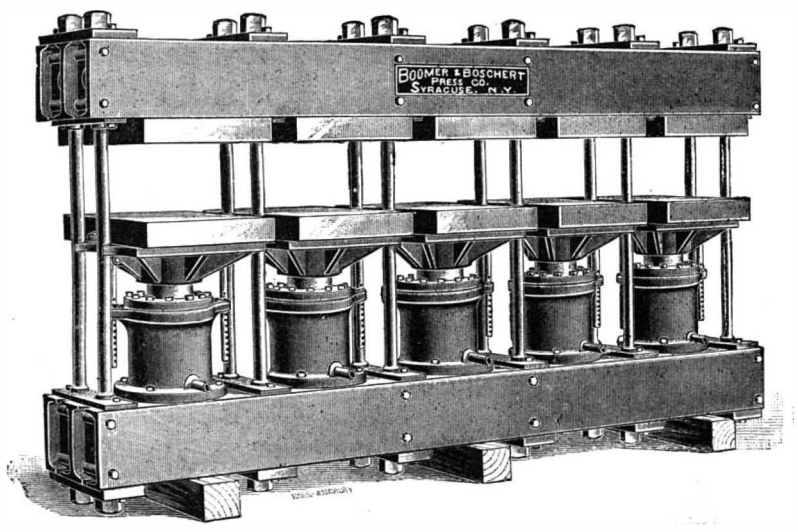
A GANG HYDRAULIC STEAM PRESS.

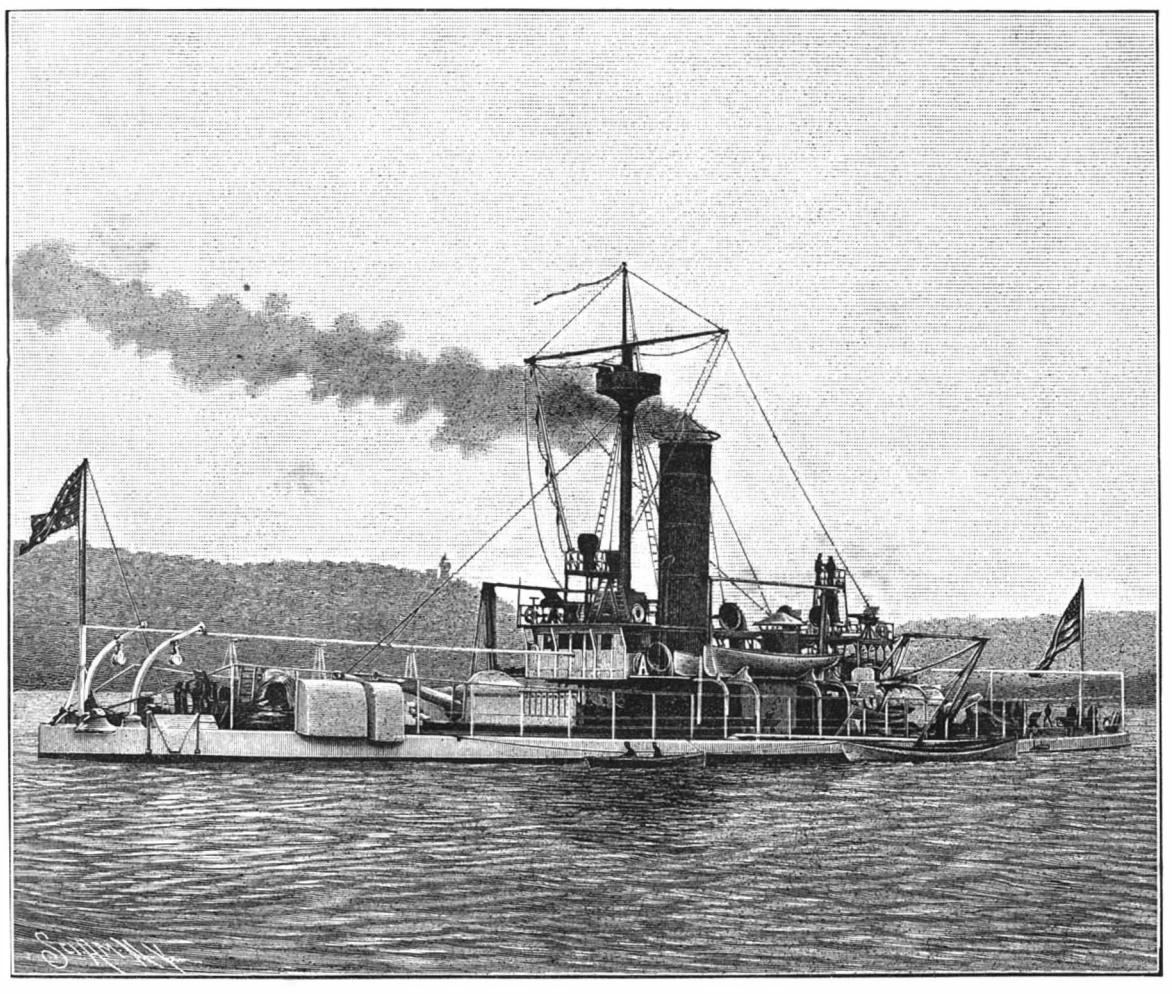
The improvements which have been made in all descriptions of presses by the Boomer & Boschert Press Company, of Syracuse, N. Y., during the past twenty years have been little less than remarkable, and have fully kept pace with the demands of manufacturers in all lines of industry. In hydraulic presses, especially, the company has been particularly successful in building work for a great variety of uses, but all distinguished by strength and simplicity of construction and operation. The illustration shows a gang of small presses, built by the company, to be operated from an accumulator, and which can be constructed in this manner at less cost than separate presses. Each press is, however, independent. The head and base are formed of continuous steel beams, and the construction and operation will be readily understood. In order to save opening the press to its fullest extent each time, and to adjust for different thicknesses of moulds, stops are provided consisting of shafts attached to and dependent from the platens, passing loosely through holes in the lugs cast on the cylinders, with holes and pins for limiting the drop of the platen. The number of presses in a gang may be from two to ten or more.



A GANG HYDRAULIC STEAM PRESS.

THE MONITOR MIANTONOMOH.

It is worthy of note that the first service of this vessel, after her recent completion, was in the firing of the salute in connection with the unveiling of the Ericsson statue, and taking part in the ceremonies of the naval parade which signalized the inauguration of the era of the Columbian Exposition. The keel of the vessel was laid by John Roach & Sons, at their works on the Delaware River, in 1874, and she is in many respects a reproduction of the old wooden monitor Miantonomoh. She is 250 feet long, of 55½ feet beam, with a draught of 14 feet, a displacement of 3,815 tons, and indicated horse power of 1,030. She has only about 3 feet of freeboard. The ship is of iron except the armor plates, which are of steel, the hull having a protective belt 6' feet deep and 7 inches thick. The outer plating of the turrets is 11½ inches thick, backed by 10 inches of wood, this being again backed by two steel plates, each ½ inch thick. The turrets are 24 feet in external diameter, and rise a little over 6 feet above the deck. They are each surmounted by a conning tower a little less than 8 feet in diameter at the base, and projecting two feet above the main turrets. In each turret are two 10 inch breech-loading rifles manipulated by hydraulic gear. The vessel also has a fighting mast of hollow steel through which ammunition is hoisted to a fighting top. She has a double bottom, there being a clear space of 28 inches between the two skins. She is lighted throughout by electricity. Her speed is rated at 10½ knots per hour.



THE MONITOR MIANTONOMOH.

Acetic Acid as a Menstruum.

Professor Remington has been advocating, at a meeting of the Philadelphia College of Pharmacy, the use of sixty per cent acetic acid as a menstruum for extracting drugs. The suggestion was not put forward as a novel one, but it was urged that the acid is an excellent solvent of the active portions of drugs, and is both preservative and antiseptic. Dr. Squibb has obtained very definite and positive results by its use. It appears to form soluble compounds with the active principles of drugs in many instances. Acting on the knowledge that volatile oils are very soluble in the acid, Professor Remington has prepared specimen extracts from various spices by its aid, treating them with four times their weight of the solvent. The whole of the active parts of cassia, cinnamon, cayenne, etc., are said to be extracted and inert residues left. As regards commercial value, acetic acid is, of course, far preferable to alcohol, and it is said to be more effective, weight for weight, than alcohol of the same strength.

According to the *Pharmaceutical Review*, experiments made with nux vomica and belladonna disclosed the fact that complete exhaustion can be obtained by the aid of this medium in less time than with an alcoholic menstruum, while fluid extracts, intended primarily for culinary purposes, are now prepared in a similar way from cinnamon, cloves, cardamom, pepper, ginger, mace, nutmeg, celery, pimento, garlic, mustard, vanilla, and tonka bean. In strength each minim of the finished extracts represents one grain of the material operated upon, and the preparations are said to be admirably adapted to the purposes for which they are intended. They are perfectly miscible with water, and are not of necessity more than slightly acid, since the excess of acid in the weak percolates can be recovered to a great extent by distillation.

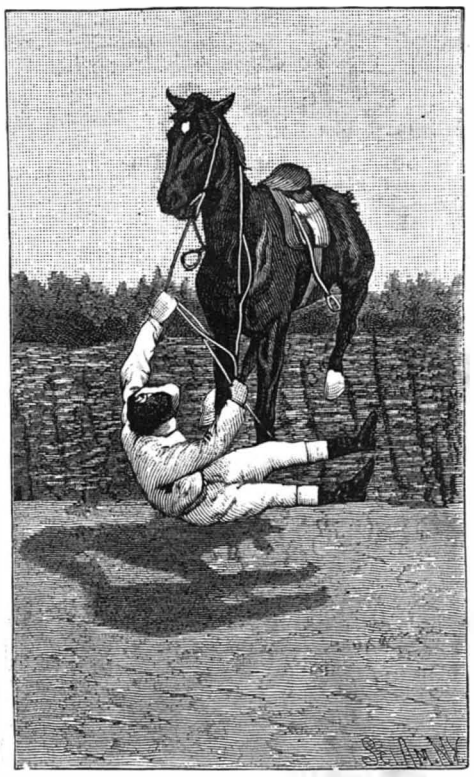
The Australian Frozen Mutton Industry.

Some idea of the gigantic proportions which this industry has attained may be gathered from the fact that one of the establishments alone, the Australian Chilling and Freezing Works, at Aberdeen, on the Great Northern Railway, 162 miles from Sydney and some 87 miles beyond Newcastle, can freeze 850 and chill 1,500 sheep daily. The vessels load at Newcastle, a special train conveying the mutton to that port, where as many as 6,000 sheep have been loaded in one day. The steamers carry their cargoes to England. The vessels are provided with refrigerating machinery and deliver their cargoes in frozen condition.

THE Pharos lighthouse, Alexandria, was built B. C. 285; height 550 feet, light visible 42 miles.

BETWEEN SADDLE AND GROUND—AN INSTANTANEOUS PHOTOGRAPH.

Many curious pictures are now frequently seen as a result of the facility with which instantaneous photographs can be taken. Our illustration represents a view of this kind, where a rider has been thrown from his horse but has not yet reached the ground. The incident occurred at a steeplechase meeting at Ashey, in the Isle of Wight, where Mr. R. Thirlwell's horse Cosmetic refused his third hurdle, and threw Mr. R. Woodlands, his rider. Mr. Charles Knight, of the Royal Studio, Newport, was on the spot with a camera, and he was fortunate enough to get a "snap shot" of the incident just as Mr. Woodlands was falling to the ground, the effect being to make the latter appear as if performing an acrobatic impossibility by supporting himself horizontally on the reins. For our illustration we are indebted to the London *Graphic*.



BETWEEN SADDLE AND GROUND—AN INSTANTANEOUS PHOTOGRAPH.

Something to Think About.

Mr. Carroll D. Wright gives us some very interesting facts. He estimates—and in the matter of statistics he is an expert—that there are in this country at the present time rather more than twenty-two millions of persons who are "engaged in gainful occupations."

Subtracting from our sixty-five millions most of the wives and daughters, all of the decrepit and aged, and all the school children, it will be seen that we are a work-a-day nation in its shirt sleeves. The class of do-nothings because they have too much money and the other class of do-nothings because they are born loafers do not count for much either in number or influence. But Mr. Wright adds that not only is the aggregate of those who do work on the increase, but also the aggregate of those who are willing to work, but can't get it. There's the rub. That is the reason for the existence of labor organizations, for strikes, and for the unceasing conflict between capital and labor.

The remedy? There is but one. Skilled labor is nearly always in demand. A first-class workman is seldom out of a job. It is necessary, therefore, for the new generation to cease dawdling, to give up being jacks of all trades, to give themselves vehemently to some special department, and to become masters of that. There never yet was a time when it was not easier to earn $4 a day because you are worth it than to earn $1 a day at work which a million others can do as well as you; and, as the New York *Herald* says, the lesson is clear and it is emphatic.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR VESTIBULE CONNECTION.—Walter N. Thompson, St. Louis, Mo. A series of springs is secured to the vestibule face plate and extends around the passageway, rods on the outer ends of the springs having their lower ends secured to sliding arms in the car platform, there being cross braces on the rods and springs and a flexible face secured thereto. The improvement forms a yielding flexible connection which does not have any buffer action, and is not intended to affect the movements of the train, but will form an air-tight seal, excluding all rain, snow, dust, etc., the protection being equally good in going around curves. It may be easily attached to the cars.

CAR DOOR.—Napoleon Roy, Duluth, Minn. This invention relates more especially to inside doors for grain cars and their fastenings, providing a door which can be easily operated without using crowbars, etc., the fastening attachments not interfering with the use or capacity of the car for coal or other freight. A slide door is pivotally supported at its upper end over the doorway, so that it may be tilted, in connection with locking devices and a lifting mechanism, the latter consisting of a chain or cord, by pulling on which the door may be unlocked and moved upward without tilting.

AUTOMATIC CAR SWITCH.—Joseph A. Hawkins, Brooklyn, N. Y. This switch is designed for use in connection with electric, cable, or horse cars, and is designed to enable the driver to quickly and conveniently switch a car from one track to another while the car is in motion. A switching rail is arranged adjacent to one of the rails, and at its outer side a counterpoise lever, one end of which is connected with the switching rail, while a shaft is connected with the switch points, and a connection is made between the shaft and the counterpoise lever, whereby one is operated from the other.

AUTOMATIC GRIP OPENER.—William P. Courtney, Oakland, Cal. This is a simple construction, designed to release the grip at the "let-go" in case the gripman should forget to do so. Combined with the grip is a pitman having a sliding and rocking connection with the grip lever, a link being pivoted at one end to a bell crank lever and its other end to the pitman, while a safety bar is connected with the lever. The improvement may be readily applied to any ordinary form of grip without change of construction.

Mechanical.

LET-OFF FOR LOOMS.—Patrick Duffy, New Bedford, Mass. This is a mechanism to let off the warp yarns from the warp beam or roller, and give the proper tension to the warp. A simple apparatus which carries a dead weight is arranged at one side of the shaft and actuates the weight by a shoe or arm, to shift the weight as the warp is wound off, thus keeping an absolutely even tension on the warp without regard to the amount of warp on the beam or roller. The mechanism is readily adjustable and is not liable to get out of repair.

PERFORATING MACHINES.—Jacob B. Hemsteger, Piqua, O. A simple and durable automatic feed mechanism has been provided by this inventor, insuring the making of rows of perforations in the paper at any desired distance apart. A gripper engaging one end of the paper is mounted to slide a predetermined distance, the gripper being actuated periodically from the needle bar of the perforating machine.

CLUTCH MECHANISM.—Gottlieb F. Tinney, New York City. This is a device for a machine for working or breaking raw hides to render them soft and pliable, the working being effected by coiling the hides upon a shaft or drum and then reversing the motion to uncoil them. A novel and compact arrangement of cam, gear, and clutch mechanism is provided, to connect with the driving shaft and drum, the driving shaft rotating constantly in one direction while the drum reverses itself at the end of every seventh revolution, so that the machine is entirely automatic.

WATERPROOFING PAPER.—John J. Newman, Elkhart, Ind. This is an improvement on a formerly patented machine of the same inventor, by means of which paper leaving the calender rolls passes over hot rolls, under a hot smoothing roll and between supplemental squeeze rolls. The paper is fed over a wax bed, where it receives on its lower face wax forced up through slits from the feed chamber until thoroughly saturated. The hot bed plate and hot smoothing roll polish and keep smooth both faces of the paper, and by the additional hot squeeze rolls the waste is removed. Two connected tanks afford means of keeping the wax at a proper consistency for continual re-use, thus effecting economy and rendering the application of the coating material uniform at all times.

Agricultural.

POTATO DIGGER.—Isaiah H. Van Horn and William Neel, Thornville, Ohio. To the draught beam is connected a plow standard having at its lower end an A shaped detachable shovel, of different sizes for different uses, wings being bolted along the edges of the shovel and the standard. The upper one of the wings is hung loosely to the standard, so that it is free to rise and fall, rising just enough to throw off the weeds and vines, leaving the ground level and the potatoes scattered in the rear of the digger. The improvement affords a combined cultivator and potato digger, which may also be used for ditching, furrowing out, splitting middles, hilling up, and it may be cheaply and strongly made by any blacksmith.

STRAW STACKER.—John P. Wheeler, Quincy, Ill. A distributing attachment, for removable connection with the straw chute of a stacker, has been designed by this inventor, and it may be adjusted to distribute the straw delivered from the chute either in an outward direction to trim up the outer sides of the stack, or scatter it around the central or marginal portions. The driving mechanism of the stacker is utilized to operate the attachment, which is readily adjustable for any size or height of stack, and works automatically, saving hand labor.

FRUIT PICKER.—Anders W. Ohman, Tunsta, Insjon, Sweden. A long rod or handle carries at its upper end a plate ring, on the upper and inner edges of which are projecting teeth or knives, while secured to the under side of the ring is a flexible chute supported upon the handle and terminating at its lower end in a collecting bag. The knives or teeth of the ring are made to cut the stems of the fruit by movement of the handle, when the fruit drops through the chute to the bag without injury.

HOG TRAP.—James F. Boman and John Cornelius, Flat Rock, Ind. This is a combined trap and shipping crate, the trap forming also the crate. It has at its rear end a door sliding in guideways, and at the front a horizontally swinging hinged door on which is pivoted a lever with a recess in one edge opposite a recess in a board of the door, a keeper on the lever, and a toothed arm pivoted on the door extending through the keeper. The lever is adapted to hold the animal's head in the opening, which may be made by the two recesses, in order to put a ring in the animal's mouth, etc.

Miscellaneous.

TYPE WRITING MACHINE.—Alfred N. Heine and William K. H. Woerner, Evansville, Ind. This is a machine designed to be cheap, durable, and of simple construction, easily operated, and calling for but little skill in its manipulation. It has a peculiar form of hollow prismatic type bar, carried on a type rod, and having a number of faceted sides on which may be produced any desired number of characters, preferably electrotypes, the bar sliding and turning on the type rod. It also has a convenient arrangement for moving the carriage backward and forward, by which the printing may be seen as fast as made.

FAN AND MOTOR.—George A. Snecker, San Antonio, Texas, and Charles E. Roth, New York City. A spring motor is held in a clock-like casing, in such manner that, through suitable mechanism, the spring is adapted to operate a fan shaft, with which a fan is adjustably and removably connected. The device may be readily attached to any article of furniture or other support, but is especially adapted for attachment to a bedstead.

FOUNTAIN PEN.—Marcellus M. Hitt, Luray, Va. This invention provides an attachment whereby an ordinary pen may be converted into a fountain pen. It consists of an elastic sleeve, as one made of soft rubber, with a flexible tongue having on its end a dovetail tip for insertion in the aperture of the pen, the tongue and the pen together forming a reservoir for ink, which is fed automatically as the writing proceeds.

ENVELOPE OPENER.—Julius Ropes, Ishpeming, Mich. This is a device for cutting or opening folded edges of different material, the case having a grooved guide for the folded portion of the material to be cut, and being provided with an angularly arranged cutting blade. The device is also well adapted for cutting the leaves of books, etc. It can be made in light, compact, and ornamental form, suitable for carrying in the vest pocket, and can be readily taken apart to sharpen the two blades it is usually designed to carry.

BOOKBINDING.—William P. Sloan, Knoxville, Tenn. This invention provides for the connecting of signatures or sections by a binding thread with a cord held on the back of each signature or section, the binding thread also forming a loop on the cord for the passage of the transverse bands. By means of the improvement it is designed to produce a compact and strong book, adapted to be fully opened, so that its leaves will lie perfectly flat for conveniently writing upon.

SLED.—James W. Taylor, Vermillion, South Dakota. A simple and durable bob sled has been designed by this inventor. It is arranged to permit the runners to readily pass over uneven surfaces in the road without disturbing the position of the box. The front and rear axles are connected with each other, and the runners are mounted to swing on them, a fifth wheel with which a bolster is pivotally connected being held on the front axle, while there is also a fifth wheel connection between the front bolster and its bearing.

SLEIGH GUARD.—Charles N. Hartling, Halifax, Canada. According to this invention, flat elongated blades or auxiliary runners lie flat against the sides of the runners, means being provided for raising and lowering the blades, so that when they are lowered they will serve as runners and prevent sidewise movement of the sleigh. The guard is adapted for use upon any vehicle designed to run upon the snow or ice, and may be easily operated by the rider, and thrown below the shoes or runners to engage the snow or ice, causing the vehicle to run straight, but not acting as a brake.

LADDER AND TRUCK.—Moritz Roessler, Jr., College Point, N. Y. A ladder which may be quickly raised to a great height, with its base resting on the truck by which it is carried, is provided by this invention, the ladder being effectually braced from the top to the bottom. The raising and lowering mechanism carried by the truck is of a novel description, and at a proper point in the ladder is provided a platform. Means are also provided whereby the ladder, when elevated, may be brought to a vertical position or placed at any desired inclination.

ROOFING TILE.—Francis Andreu, New York City. This is a tile of simple and durable construction, designed to effectively drain and carry off the rain water without danger of leakage. It is made of fire clay or other suitable material adapted to be readily pressed into shape. The tiles completely interlock on the sides to prevent lateral displacement, and fit one on top of the other longitudinally, to prevent dislocation in this direction. The body has corrugations forming, on the under side of the tile, channels for the passage of air, and on top channels for draining rain water, at the same time giving considerable strength from the arch shape of the corrugations.

TRAP DOOR FOR MINES.—John Rees, Hamilton, Iowa. This door is hinged in a stout supporting frame to open in both directions, automatically closing when opened either way. It is preferably made in two face sections, and its frame is formed to fit at the desired point in the mine passage, and be moved from place to place as may be desired. The construction is such that the door retains its position against the air without the use of springs or other devices, keeping the air under constant control and thus affording a safeguard against explosions, while also saving labor and preventing accidents from the carelessness of door tenders.

BOOT TREE.—James Bowler, London, England. This is an improvement in boot trees formed of two parts hinged together, and provided with extended portions to serve as handles for manipulating the tree. The toe and heel portions are of the usual shape exteriorly, and they are hinged together at about the ankle, with a space between their under sides to permit the heel portion to fold beneath the other and allow the tree to be readily introduced into a boot, the parts being then forced apart by pressing on the two upper portions the tree being then locked in extended position by a latch. For convenience of racking, the front portion is made in two parts, united by a hinge, and fixed in rigid position for use by a screw.

TAILOR'S MEASURE.—Abraham M. Cone, Lee, Mass. This is an instrument consisting of a horizontal back bar having a spirit level at or near one or both ends, adjustable horizontal side bars at right angles having spirit levels near their outer ends, and an upright rod or bar in sliding or adjustable connection with one of the side bars. The device is designed to facilitate the taking of more accurate measures by getting in a direct manner points on a level to work from.

CONSTRUCTION OF BASKETS, ETC.—Peter F. Pia, New York City. This invention provides an improved construction of baskets and other receptacles made of metal, and having their meeting edges fastened together by solder or other means. The basket is formed with a series of side flaps, the meeting edges of which are provided with a dovetail groove and projection, the ends of the projections or lugs being flush with the outer faces of the flaps and secured in the grooves by compressing the walls of the latter. The fastening devices are struck up in the blanks of which the baskets are formed, whereby a better and cheaper article may be made.

DUST BRUSH.—John J. Hassard, Harrison, N. J. This is a brush adapted for use upon the walls and ceiling of a room. Its projecting bristles are secured in the face of a core upon a shaft journaled at one end of a long handle, there being also a pulley upon the shaft, and a belt connection whereby the shaft may be rotated by means of a crank near the other end of the handle. The handle has a swinging joint near its outer end, to turn the brush end in a horizontal direction for use on side walls, and other joints of the handle, connected by sleeves or sockets, permit of its being made of any desired length.

FOLDING BED.—Henry B. Young, New York City. The bed frame carrying the mattress is made of angle iron, and pivots near the head turn in bearings of the standards, wrist pins being secured to the pivots, and a flat spring in each standard pressing with its free end on the wrist pin of the corresponding pivot, while each spring is also provided with an extension resting on one side of the standard. The construction is simple and durable, and the bed is readily accessible in all its parts for cleaning and other purposes. It can be conveniently set up, adjusted and counterbalanced, for folding or extending the bed, which is securely held in either position.

LAMP SUPPORT.—James R. McGregor, New York City. This is a device more especially designed for use on sewing machines and similar purposes, supporting the lamp so that it does not interfere with the work and at the same time so that the rays are thrown where the light is required. It consists of a hanging bracket readily secured to the machine, with horizontal longitudinally slotted arm and depending socket in which the shank of the lamp stand may be vertically adjusted, and the lamp be thus readily raised or lowered.

SAD IRON.—Milton J. Shimer, Freemansburg, Pa. The body of this iron may be of any desired shape, but it has a central transverse staple, with a pair of lugs at each end, on its top face. The handle is detachable, and provided with means for readily gripping and letting go of the staple. To remove the iron from the stove, the handle is simply pressed into position to engage the lugs, thus fixing the handle in place, and when the iron is placed upon the stove its handle may be removed by pressing with the thumb upon a lever extending up at one side.

KITCHEN UTENSIL.—Bertha A. Backman, Malden, Mass. This is a cone-shaped shield, composed of two half sections having a sliding connection with each other, for attachment to frying pans to prevent the spattering of grease upon the stove. It has wire legs at the bottom, and may also be placed on a pot, etc., in boiling meat or vegetables, to prevent the water from boiling over, or it may be used to support a plate or dish to be heated.

TOY.—Norman Allen, Rockaway Beach, N. Y. This toy is in the shape of an egg, and contains a follower over which is a folded ship or other object, so arranged that the whole may be pressed down and concealed within the egg-like body until one end is pressed down upon a support, when the folded object will be forced outward and will automatically unfold and assume its normal shape, standing thus upon one end of the upright egg as a pedestal. The object may then again be readily folded and pressed back into the body as at first.

Designs.

SPOON.—George Freund, Durango, Col. In the bowl of this spoon is a bird's eye view in which appears a river crossed by several bridges, and a series of buildings forming smelting works, with their smoking chimneys, etc.

POCKETBOOK.—Isaac Scheuer, New York City. This pocketbook has on its outside an additional smaller pocket, the inner sides and bottom of which are arranged to give a flexible and loose effect, in contrast to the rigid face of the side of the pocketbook.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

WHAT SHALL I LEARN? OR THE YOUNG MEN'S BUSINESS GUIDE. Philadelphia: Standard Publishing Co. Pp. 221. Price $1. No index.

This little work purports to detail, for some 60 different occupations, the methods of beginning work at them, the method of learning the business in each case, the salary required and the probable prospects of remuneration. A very great range of occupations is covered, and the statement of wages and prospects, while perhaps, in some cases, a little too sanguine, is, on the whole, characterized by conservatism. The preface justly states that the book is radically different from anything that has gone before it. For each trade two to six pages are used to cover a subject. The grade of occupation runs all the way from the analytical chemist, engineer, banker, lawyer, and stock broker down through the trades to glass maker, baker, lithographer, and wood engraver, so that nearly every one can find something about occupations within their scope. The book, while lacking an index, has a table of contents which really seems to make the index unnecessary. Moreover, the subjects are arranged alphabetically.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. IX. Published by the Institute, New York City. Pp. lx, 857.

The Transactions of the American Institute of Electrical Engineers always forms a welcome publication. The subjects of the papers and discussions indicate those of the day. We can really do no more than commend the work to our readers, as it would be quite impossible in the limits of our space to give anything more than the barest summaries of any of the papers. One thing to be noticed with satisfaction is the number of illustrations, and the general creditable make-up of the book is also most commendable.

FIFTEENTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF THE STATE OF CONNECTICUT FOR THE SEVEN MONTHS ENDING JUNE 30, 1892, WITH THE REGISTRATION REPORT FOR 1891 RELATING TO BIRTHS, MARRIAGES DEATHS, AND DIVORCES. New Haven: Tuttle, Morehouse & Taylor. 1893. Pp. xl, 194.

SCIENTIFIC AMERICAN BUILDING EDITION.

MAY, 1893.—(No. 91.)

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2. Plate in colors showing a handsome residence at Rutherford, N. J. Two perspective views and floor plans. Mr. F. W. Beal, architect, New York. An attractive design.
3. A handsome dwelling at Plainfield, N. J. Perspective views and floor plans. A model design. Messrs. Hartwell & Richardson, architects, Boston, Mass.
4. A dwelling at Utica, N. Y., erected at a cost of $4,700 complete. Floor plans, perspective view, etc. Mr. W. H. Symonds, architect, New York. An Old Colonial style of architecture.
5. Engravings and floor plan of the Fairfield Congregational Church at Fairfield, Conn., erected at a cost of $52,000. Messrs. J. C. Cady & Co., architects, New York City.
6. A stable erected at Plainfield, N. J. A model design. Messrs. Hartwell & Richardson, architects, Boston, Mass.
7. An excellent design for a modern stable at Bridgeport, Conn. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn.
8. A residence at Belle Haven, Conn. A very picturesque design, perspective elevation and floor plans. Cost $6,000 complete. Mr. Frank W. Beal, architect, New York City.
9. View of a tasteful shop for a builder erected at Neuilly, Paris.
10. The Fifth Avenue Theater, New York.—View of the Worthington steam fire engine pump.—View of the Hygienic Cement and Asphalt Company's watertight scene pit. View of the Edison Electric Illuminating Company's switchboard, with particulars of construction, etc.
11. Miscellaneous contents: A Pacific coast bathing establishment.—An improved spring hinge, illustrated.—The Lewis open fire base burner, illustrated.—The J. A. Fay and Egan Co.—The H. W. Johns paints, etc.—An adjustable sash holder, illustrated.—A labor saving screw driver, illustrated.—A self-feed rip saw, illustrated.—Shipping a factory across the Atlantic.—Architectural wood turning.—Tunneling the Simplon.—New resawing band saw machine, illustrated.—The Wheeler wood filler.—An improved hip shingle, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Minerals sent for examination should be distinctly marked or labeled.

(5041) W. D. writes: You will oblige me by giving an explanation of the phenomenon described below. It was observed on the 16th of March, at a point on the eastern slope of the Blue Ridge, about half a mile from the base of the mountain. There were no well defined clouds over the sky, and no appearance of rain showers; but the sky was covered only with a light film of haze, not enough to obscure its blue color. The phenomenon was an arc of rainbow-like spectrum, distinctly green to yellow, but faintly defined as to the other colors of the rainbow. Its length was apparently 45°. Its position was between the zenith and the sun, apparently 10° from the zenith, and 45′ from the sun. It was convex toward the sun, the zenith being its apparent center. The phenomenon was first seen about 4 o'clock P.M., and lasted at least an hour. The above description agrees with the observation of more than twenty persons. A. The phenomenon described is a solar halo occasionally seen during peculiar conditions of the atmosphere and generally preceding a change of weather. They are supposed to be caused by the refraction and reflection of sunlight by flakes of snow in the upper atmosphere, the various forms of snow flakes producing the variation in the form of the halos. They are described in Kaemtz "Meteorology."

(5042) A. H. P. asks: 1. Why is the water on small bodies of land surrounded by salt water, fresh. And where does it come from? A. The water on islands surrounded by salt water is derived from the rain falling upon the island, except in some peculiar localities, in which it is derived from subterranean communication with the main land through deep gravel beds. 2. Does the fair weather wind blow from the north and the foul from the south in all regions? Why is it thus? A. Fair weather winds blow from both north and south in most regions where special conditions of climate do not prevail, as in the eastern United States. There are many localities where south and southwest winds are storm breeders, while the northeastern wind in the Eastern States is usually a storm wind. West of the Rocky Mountains the conditions are somewhat different, owing to the different direction of the coast line and the great mountain ranges from the coast line and mountain ranges of the Eastern States. The elevated plateau between the Rocky Mountains and Sierras also influence and localize the direction of storm winds. The story of storm winds is a long one for Notes and Queries. It is well illustrated and described in Hinman's "Eclectic Physical Geography."

(5043) C. E. E. asks (1) for some scale for sizes of wire in making electromagnets. What size wire for magnets for door bells, etc. A. The winding of the bell magnets is generally arranged with reference to the electromotive force of the battery and its resistance. The common rule is to make the resistance of the battery equal to the magnet and line wire. 2. I would like to know the size of wire for magnet for a 3 and 4 inch bell, and how large wire, and how large size should a magnet be for a quarter inch core? A. For a bell of the size named the cores of your magnet should be 7-16 of an inch in diameter, 2 inches long, and the depth of the winding should be equal to the diameter of the core. The rule in regard to the depth of the winding applies to your ¼ inch core.

(5044) A. S. writes: I desire to protect safe in office, which is ½ mile from residence, against burglars, by electric bells, by means of circuit breakers on office doors and windows. If an open circuit is used wire might be cut, if closed circuit it might be grounded. Is it possible to use one line wire for both open and closed circuit system by alternately making the line at intervals of 30 minutes an open and then a closed system through the agency of a clock or clocks or other mechanism, and thereby detect trouble within 30 minutes, if the line has been either cut or grounded. If it is impossible to do so, please state if it must take two lines, one open and the other closed system, and take the chances of burglars cutting the wrong or grounding the wrong wire and thereby give the alarm? A. Without doubt your best plan is to use both the open and closed circuit systems as you propose.

(5045) J. S. K. asks how to mould common sheet zinc into rods the size of electric light carbon pencils for use in electric batteries, and whether it would be necessary to clean the sheet zinc, or if when it is melted he could remove the foreign substance from the top. How can the mould be made and the moulding carried on in a cheap, simple manner? A. You can make a sand mould for your zinc castings and melt and pour the zinc as you would brass or any other metal. 2. Please state the price of mercury for amalgamation purposes. A. Metallic mercury is quoted at 82 cents per pound.

(5046) J. B., New York, asks: What is the largest boat I can build without requiring the service of a pilot? A. Sail boats and yachts do not require the service of a licensed pilot, nor a license.

(5047) B. W. R. asks: Do the propellers on a twin screw steamship run same way, or right and left? A. The twin propellers run right and left.

(5048) H. C. T. writes: Can you explain where and how the terms "up north" and "down south" arose? Is it due to the inclination of the axis to the plane of the ecliptic, or purely a conventional term? A. The terms "up north" and "down south" probably originated in the Eastern States, and may have been suggested by the course of the rivers, which run in a southerly direction. The position of the pole star may also have had its influence in designating the north as "up north," and of course its opposite would be "down south."

(5049) A. H. says: The awning deck of my steam launch was covered with oilcloth. The oilcloth all cracked up, no doubt from the sun shining on it. Will you please inform me with what I can paint the oilcloth, so that it will not crack? I thought that probably a coat of boiled linseed oil would preserve it. The awning deck is stationary and the oilcloth is tacked on; therefore the paint put on the oilcloth need not be pliable when dry. A. Oilcloth cannot be saved from cracking when exposed to the sun. Any desired color in ground paint mixed with boiled linseed oil will renew the surface when worn or cracked.

(5050) J. H. asks: Will there be any difference in the hydraulic pressure of a pipe say one mile long, 10 inches diameter, one end 20 feet lower than the other, with both ends closed, and pressure applied by a steam pump at the center of pipe or any other point? A. There will be no difference in pressure due to the place of the pump connection; but the lower end will have about $8\frac{7}{10}$ pounds more pressure per square inch than the upper end, due to gravity or the hydrostatic weight of the water.

(5051) E. W. asks: Was not the discovery of the moons of Mars indicated by some astronomical knowledge before it really came to pass? I read in "Gulliver's Travels" a very accurate description of the two satellites, that seems to be too close to the facts to be merely a coincidence. A. The discovery of the moons of Mars was accidental, and not from any known physical condition or perturbation of the planet, although the absence of a satellite and its possiblities has been long discussed. The Gulliver story was only a romance that accidentally turned into a coincidence.

(5052) H. C. M. asks whether it is possible to build a storage battery to be supplied from a common incandescent electric light plant that would "store" sufficient electricity to operate a one horse power motor some two or three hours per day. A. You will find a storage battery that will answer your purpose described in "Experimental Science," also in the SCIENTIFIC AMERICAN, vol. 61, page 22; but we advise you to purchase your battery from a reputable maker.

(5053) E. F. B. asks: 1. How large should the plates of a storage battery, such as is described by C. L. Woolley, be to light three 16 candle power 20 volt lamps for about four or five hours? A. The plate should be 6 × 8 inches, and you will require 11 cells of battery. 2. Please explain the difference, if there is any, between putting all the plates of a storage battery in one cell and placing them only two in a cell. A. By placing all the plates of each cell together the resistance of the battery is diminished and its amperage is increased.

(5054) G. R. W. asks: 1. Is it possible to magnetize a piece of steel about one-fourth of an inch square, and how shall I proceed to do it? A. Harden the piece of steel at the ends only, and draw the temper to a purplish brown. Apply the steel to the poles of a strong magnet, or stroke the steel with one pole of the magnet from the center to the end, and with the other pole of the magnet from the center to the opposite end. 2. Could I revolve a piece of tin, about 1 inch in circumference, by the aid of this magnet? Which would be the best way to work the same? A. There is no way of doing this with the magnet alone.

(5055) S. H. writes: 1. If you have a number of the SCIENTIFIC AMERICAN containing explanation of difference between a universal focus lens (for a photo. camera) and one which requires focusing, will you kindly send it to above address? A. There can be no such thing as a universal focus lens. The lens known by that name is simply a wide-angled lens, the back focus of which is comparatively short. With such a lens a very slight movement of the plate or lens throws the image into or out of focus, and when it is adjusted at what might be called an average focus, the picture is likely to be as sharp as it would be if the focusing were done for each view. 2. What shape, diameter, and focus lens should I use in making a camera with universal focus, to cover a $3\frac{1}{4} \times 4\frac{1}{4}$ plate? A. It is best to buy a wide-angled short focus lens from a reputable maker. The focus might be about $3\frac{1}{4}$ inches. You can get single lenses for about $3, and you can purchase a very good rectilinear lens for $12 or $15.

(5056) L. A. T. asks: 1. Have gasoline engines ever been used for thrashing purposes? If so, with what results? A. Gasoline engines have been used for agricultural purposes. We do not know that they have been applied to thrashing. 2. What advantage would they have over a steam engine? A. They would probably be lighter than a steam engine and boiler of the same power. 3. Why have they not been used more extensively? Successful engines are of practically recent date. 4. How many inches does the mercurial column fall for 1,000 feet of ascension? A. 1·117 inches.

(5057) B. M. C. asks how to cover pulleys with paper. A. Scratch the face of the pulley with a rough file thoroughly, so that there are no bright or smooth places. Then swab the surface with a solution of nitric acid 1 part, water 4 parts, for 15 minutes; then wash with boiling hot water. Having prepared a pot of the best tough glue that you can get, stir into the glue a half ounce of a strong solution tannic acid, oak bark, or gall nuts, as convenient to obtain, to a quart of thick glue; stir quickly while hot and apply to the paper or pulley as convenient, and draw the paper as tightly as possible to the pulley, overlapping as many folds as may be required. By a little management and moistening of the paper, it will bind very hard on the pulley when dry, and will not come off or get loose until it is worn out. Use strong hardware wrapping paper.—From the "Scientific American Cyclopedia of Receipts, Notes, and Queries."

(5058) L. C. D. says: Will you please give me a formula for mayonnaise suitable for an article to be placed upon the market? A.

Powdered turmeric	1 oz.
Powdered tragacanth	1 oz.
Olive oil	8 oz.
Eggs	8 oz.
Water	5¾ pt.
Ground mustard	1½ oz.
Salt	8 oz.
Acetic acid (glacial)	2 oz.
Tincture of capsicum (Or according to taste)	½ oz.
Sugar	1 lb.

Mix the first three ingredients in a mortar capable of holding one gallon, then add the eggs, which have been whipped previously, and incorporate thoroughly until an emulsion is formed; next mix separately the mustard and water, allow to stand ten or fifteen minutes, or until the flavor is fully developed, then add the last four ingredients, mix, and add the liquid gradually to the contents of the mortar. It should make a smooth, uniform emulsion; finally, strain through cheese cloth. This is a seasonable preparation, and may serve not only for the delectation of the pharmacist himself, but would furnish an article of sale as well.—*Pharm. Era.*

(5059) C. N. asks: How is artificial malachite made? A. Artificial malachite, which is susceptible of a fine polish, is made by precipitating a solution of sulphate of copper in the cold by carbonate of soda or of potash. The precipitate, which is voluminous, should be washed and dried and made into a paste with plaster of Paris and water; allow the composition to harden.

(5060) H. S. S. asks for the best method of preserving eggs. A. Cold storage is probably the best method, but the following is largely used: In the common "liming" process a tight barrel is half filled with cold water, into which is stirred slaked lime and salt in the proportion of about one-half pound each for every pail or bucket of water. Some dealers use no salt, and others add a small quantity of niter—one-fourth pound to the half barrel of pickle. Into this the eggs, which must be perfectly fresh and sound, are let down with a dish, when they settle to the bottom, small end down. The eggs displace the liquid, so that when the barrel is full of eggs it is also full of the pickle. Eggs thus pickled, if kept in a cool place, will ordinarily keep good for several months. Long storage in this liquid, however, is apt to make the shells brittle and impart a limy taste to their contents. This may be in a great measure avoided by anointing the egg all over with lard before putting in the pickle. Eggs thus prepared are said to keep perfectly for six months or more when stored in a cool cellar.

(5061) G. M. S. asks: What causes fish to die in a small quantity of water in a vessel, if the water is not changed at short intervals? Is oxygen the life-sustaining substance, the same as in mammalia, or, if not, what is it? And can the substance consumed by the fish in the water be replaced artificially, or the deleterious matter removed which causes the death of the fish, so as to prolong life say 24 or 48 hours? A. Fish depend upon the oxygen dissolved in the water. As soon as the oxygen is exhausted the fish die. You can keep up the supply of oxygen by continually aerating the water, but it will be more practical to continually renew the water.

(5062) J. S. G. says: Please inform me of the best, strongest, and most durable disinfectant for household purposes. A. Various disinfectants are used for different purposes. 1. Roll sulphur, brimstone, for fumigation. 2. Sulphate of iron, copperas, dissolved in water in the proportion of 1½ pounds to the gallon, for soil pipes, sewers, etc. 3. Sulphate of zinc and common salt, dissolved together in water in the proportions of 4 ounces sulphate and 2 ounces salt to the gallon, for clothing, bed linen, etc. Zinc sulphate is a strong poison.

(5063) W. A. C.—I noticed in your number March 25, 1892, a description of the process of using old tin cans. Can you give me any information about utilizing scraps of tin? 1st. Can the tin be separated from the iron by simply heating and melting it off in a reverberatory furnace? 2d. If acid is used to dissolve the tin, how are the iron products separated from the tin products? 3d. How is the tin salt then made commercially available? A. The tin cannot be separated from the iron by heat. The tin scrap is boiled in weak hydrochloric acid until the tin is dissolved. The tin solution is made into perchloride or tin salt, as used by dyers, and into oxide for polishing. Any form of tin salt is salable in the chemical trade.

(5064) A. P. G., writing from Meridian, Miss., says: One of the firms of this city, in connection with their business, run a small gasoline engine, the boiler of which is made of heavy sheet copper, and is 18 inches long by 9 inches in diameter. The water was all blown out of the boiler night before last and left dry. Yesterday morning their helper lit the gas as usual, not knowing the boiler was dry. The gas had burned some little time before he noticed that he had no water. He started the pump by hand, and the boiler immediately collapsed. The center puckered and lapped and contracted to 1¼ inches hollow, while the boiler was dented and warped all over. What caused it? A. The water could not have been entirely blown out of the boiler, enough being in to fill it with steam, which condensed when the cold water was pumped in, producing a vacuum, and the inward pressure of the atmosphere, nearly 15 pounds to the square inch, caused the collapse of the boiler.

(5065) C. L. writes: 1. I take the liberty of asking for information in regard to a set of storage cells made by myself. My cells consist of lead plates, 5 inches × 6 inches, placed in round jars, 6 × 8, such as used for the ordinary gravity cell. The plates are three-sixteenths inch in thickness, having about 50 one-half inch holes drilled in regular order. I have filled these holes and covered the surface of the plates with a thick paste of red lead and dilute sulphuric acid for the negative and litharge and acid for the positive plates. Is this proper, or should red lead be used for all the plates? The first cell consisted of three negatives and two positives. This cell was charged with the current from four gravity cells, and would run a Porter motor No. 2, requiring two volts E. M. F. and two amperes, about one hour. I have since constructed two more cells, using in one cell four negatives and four positives, and for want of sufficient plates used four negatives and three positives for the second cell. After charging these cells and adding the first mentioned cell, they still will only run the motor the same time—one hour. Any one of the cells will run the motor one hour. Please explain why the three do no more work than one. Is it necessary to only fill the holes in plates or also coat the plates? A. Your arrangement of cells is not favorable to the most economical working of the motor. The voltage of one cell is sufficient for the motor; by increasing the voltage you only facilitate the exhaustion of the battery. If you connect your cells in parallel, 3 cells of battery will probably run the motor three times as long as the single cell, as you will still have only two volts. 2. Does the thickness of the plate have anything to do with the successful operation of the cell, and how many amperes ought the above cell to supply? To charge the three cells, I use twelve 6 × 8 gravity cells. After filling holes and coating plates, I placed thin sheets of cardboard, the same size as the plates, between them, holding the paste in position until hardened, which took about 24 hours. I then removed cardboard and separated the plates by means of fiber strips about one-eighth inch square and bound all together with heavy rubber bands. A. The thickness of the plate is favorable to the durability of the battery; otherwise there is no advantage in having a thick plate. Your battery should yield from 4 to 12 amperes.

(5066) T. S. H. S. asks: Is it possible to get sufficient heat from steam to bake the enamel on bicycles in a reasonable time? If so, is it used extensively? What is the best method to apply steam to heat an oven, say 6 feet × 6 feet × 4 feet? The temperature should be not higher than 300° Fah. If a lower temperature (say 250°) is used, how long will it take to properly bake enamel on bicycles? Would it be more economical than gas? Any information as to what has or is being done in this line will be very acceptable. A. Steam heat is in general use for baking japanned or enameled ware. For the hard japans for bicycles a temperature of 275° should be used, and higher steam pressure than usual is required to control the heat, as there is considerable margin between the heat of the steam in the boiler and the heat delivered from the pipes in the oven. With 85 pounds boiler pressure and a short distance between boiler and oven, you can obtain the desired temperature in a close oven, as you describe, with a gridiron or flat coil on the floor of 150 feet ¾ inch pipe and 75 feet ¾ pipe on the three sides, near the bottom, the fourth side being for the door. Each coat of japan should be baked for six hours, although the time depends much upon the quality of the japan. It may not be more economical than gas, but is far more, if not absolutely, safe. To make gas heat perfectly safe from setting fire to the japan vapor is expensive.

(5067) J. W. N. again writes: On April 15, J. W. N., No. 4888, you were good enough to answer an inquiry I made concerning hollow walls. I would like now to ask, Should not a brick wall of say 8 to 12 inches, with two thicknesses of heavy tarred felt nailed on the inside immediately to the brick, then furred with 2 inch

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furring and then the usual lath and plaster, be as warm or warmer and much cheaper than any hollowwall? And also do you think that plastering a rough coat on to the brick wall inside, then felting, then furring, then the usual lath and plaster, would answer the purpose better—namely, keeping out the cold and being cheaper? And would not the same methods of finishing a brick wall inside apply to a stone wall? A. The methods you suggest will, no doubt, be somewhat cheaper, but will not give as good an insulator, for the reason that in saving the cost of the inner 4 inch wall, you lose not only the value of the 4 inch wall as an insulator, but also the air space, which by itself is better than the tarred felt or the plaster; besides, the two thicknesses of tarred felt would become a nuisance to most people, as the tar odor would penetrate the whole house for a long time. The plaster upon the inside and felting would only add a half or three-fourths inch to the thickness of a solid wall and complicate the putting on of a substantial furring by hiding the brick courses and make the nailing of the strips uncertain. Cheapness may be good in some places, but in your severe climate no dwelling should have less than 12 inch walls.

(5068) C. D. asks: 1. What is the most economical battery for silver plating? I want to do some plating in one gallon solution. Give description, dimension, and mode of construction of battery. A. For silver plating on a small scale, probably the Smee battery is the best. These batteries are made in different sizes. You might make or purchase one with two zinc plates, 4× 8 inches, ¼ of an inch thick, and a platinized silver plate, 4 × 8 inches, or, in lieu thereof, a platinized carbon plate. The zincs must be thoroughly amalgamated. The solution used is acid 1 part, water 10 to 11 parts. 2. I want, for sake of novelty, to have an electric light in my workshop. What battery and how many cells are necessary? I intend to use an ordinary incandescent lamp. I don't intend to use steady. A. We think you will find lighting your shop with incandescent lights with a current derived from primary batteries will prove expensive and troublesome. If you use a 20 volt lamp, you might be able to light it by the use of 14 or 15 Bunsen cells. 3. How is that battery made from tomato cans? A. We would not recommend it for electric lighting. It is described in "Electric Toy Making," $1 by mail.

(5069) M. O. G. — For carbon paper: Melt 10 parts lard, 1 part of wax and mix with a sufficient quantity of fine lampblack. Saturate unglazed paper with this, remove excess and press. Use tissue paper. A rather fine pointed bone stylus is excellent for tracing designs, etc.

TO INVENTORS.

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May 16, 1893,

AND EACH BEARING THAT DATE.

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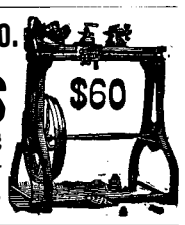

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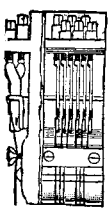

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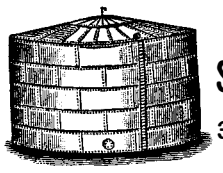

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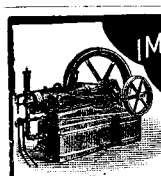

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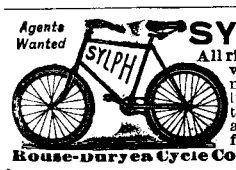

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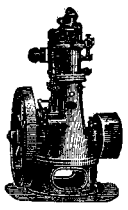

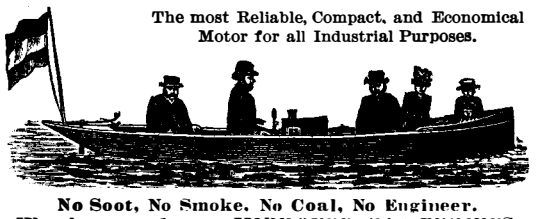

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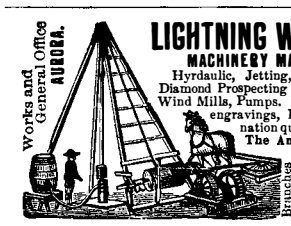

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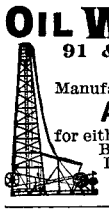

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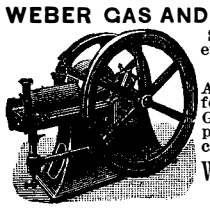

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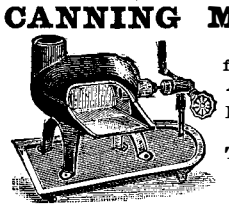

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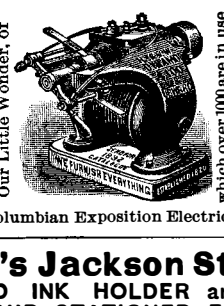

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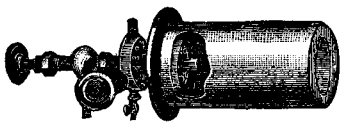

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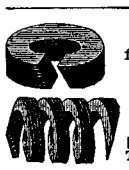

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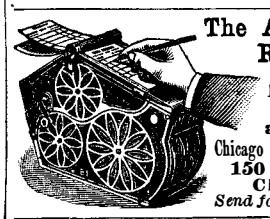

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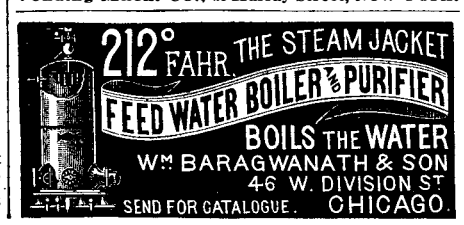
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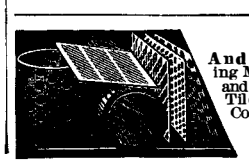

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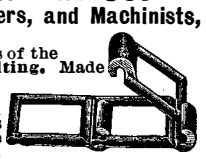

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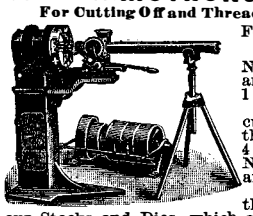

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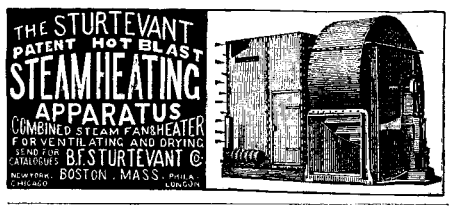
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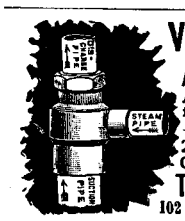

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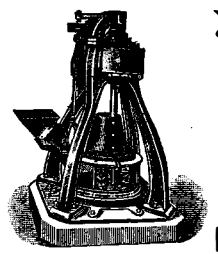

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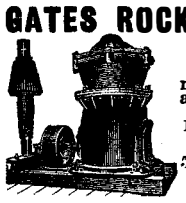

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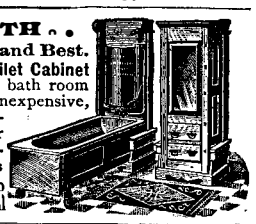

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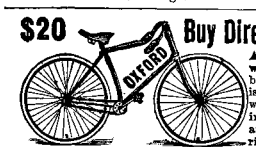
$20  **Buy Direct and Save 50 Per Cent.**

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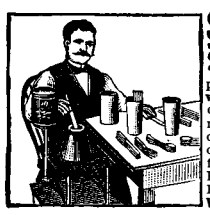

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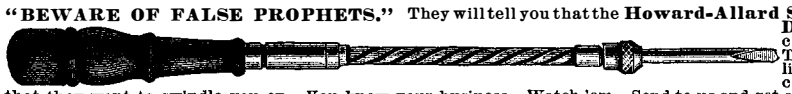

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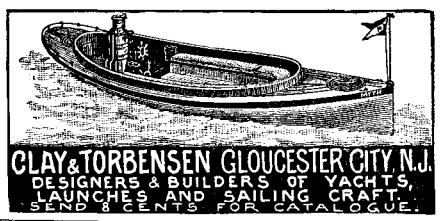

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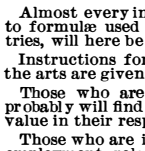

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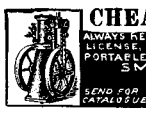

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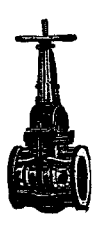

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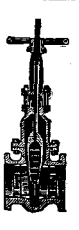

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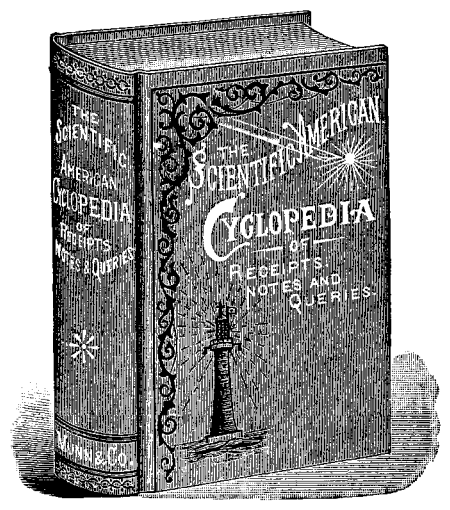

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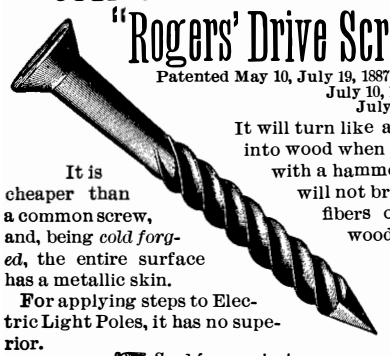

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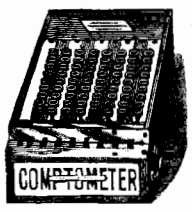

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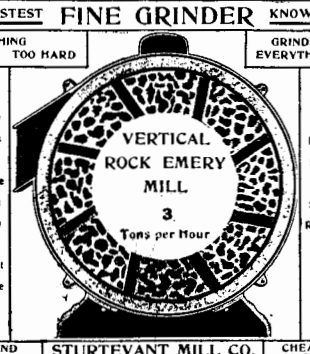

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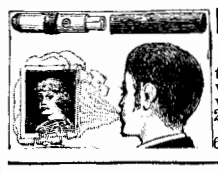

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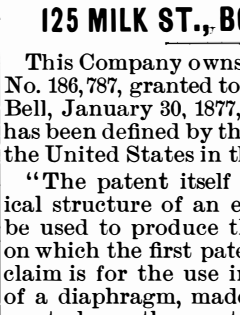

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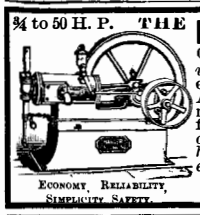

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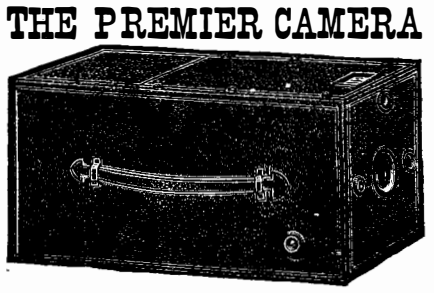

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